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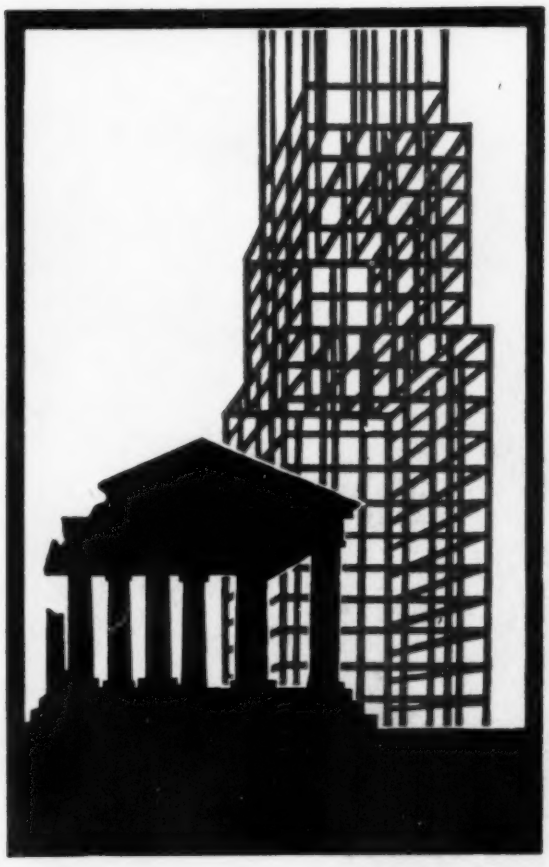

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to delicate tracery,
it is all done with

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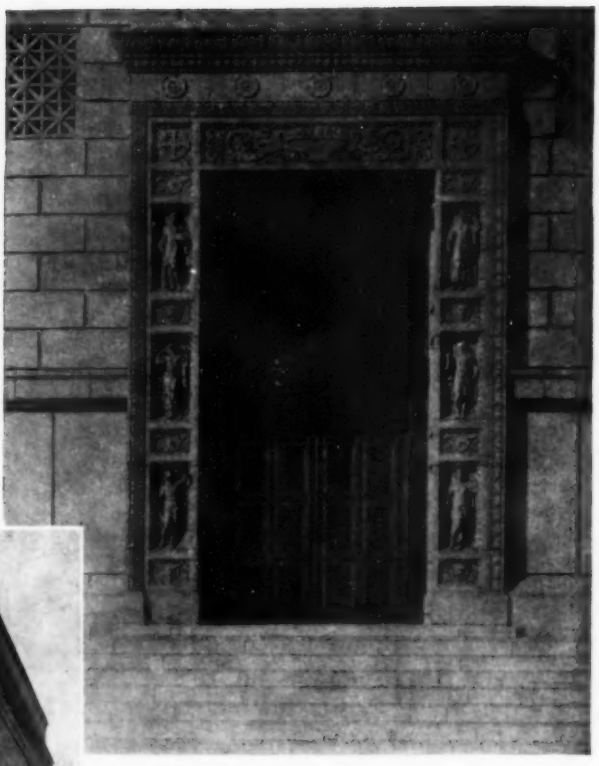

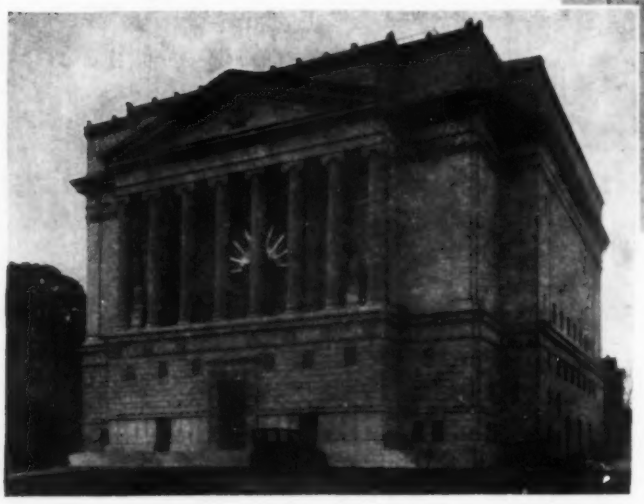

SCOTTISH RITE TEMPLE, OAKLAND, CALIFORNIA
CARL WERNER, *Architect*
McDONALD & KAHN, *General Contractor*
P. CRASSI & COMPANY, *Cast Stone Manufacturer*
PETER BRADLEY, *Stucco Contractor*

The entire front of the Scottish Rite Temple, Oakland, Cal., from the 42-foot columns down to the delicate tracery around the entrance, is concrete (cast stone) made with Atlas White Portland Cement. The sides of the temple duplicate the appearance of the front, a stucco of white cement and granite chips having been substituted for cast stone.

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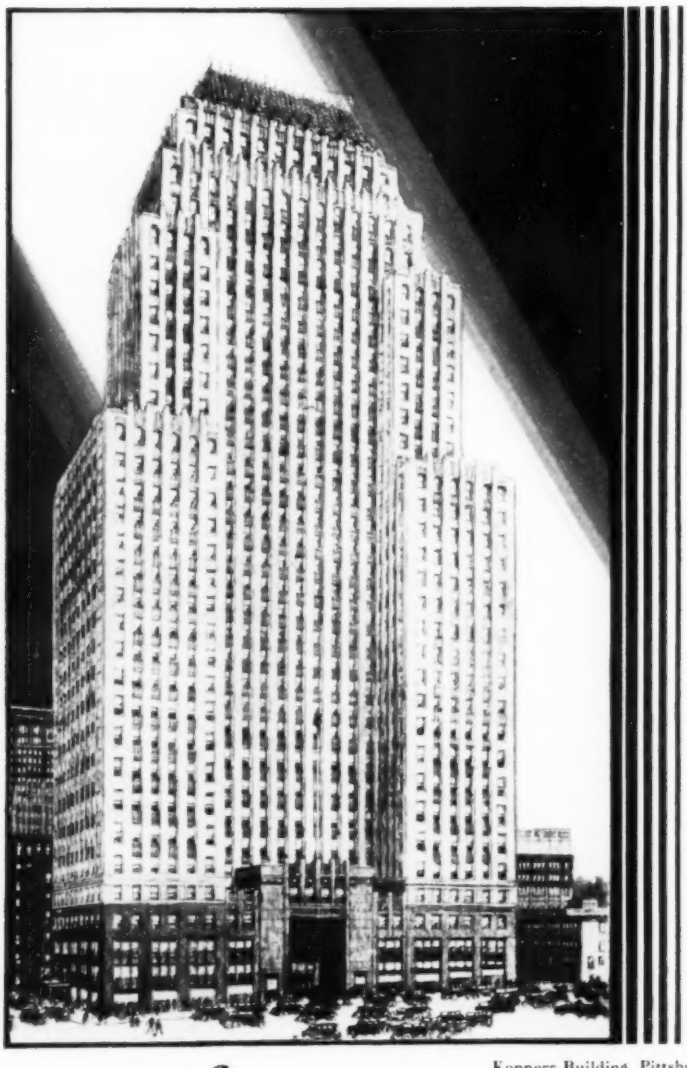

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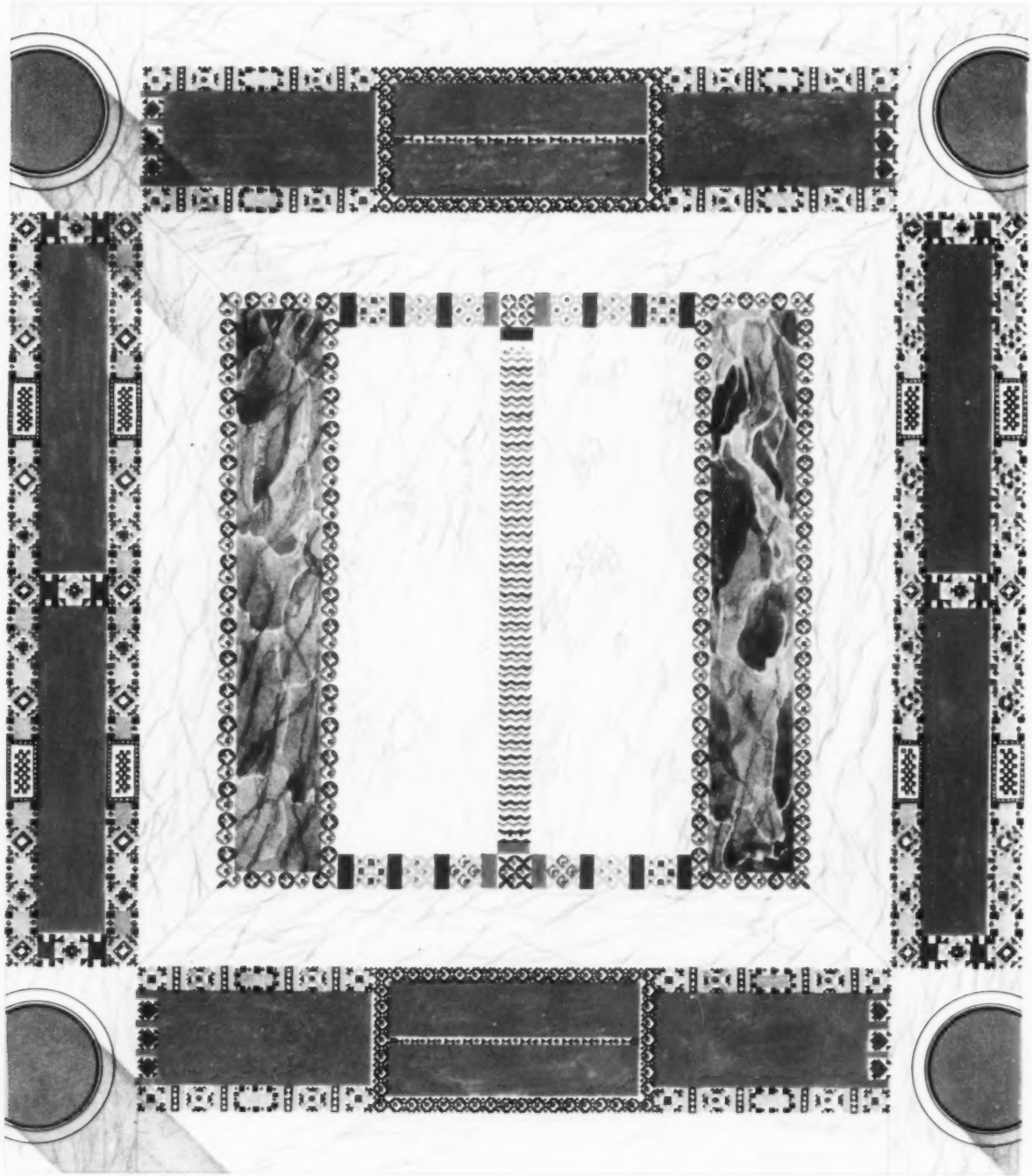
THREE COLOR-PLATES

MARBLE FLOOR IN HOSIOS LOUKAS MONASTERY, GREECE

DRAWN BY ANDRÉ LECONTE

In the Architectural Record Series of Polychrome Floors



MARBLE FLOOR IN HOSIOS LOUKAS MONASTERY. GREECE

. PLANE .

ARCHITECTURAL RECORD SERIES.
POLYCHROME FLOORS
ANDRÉ LECONTE, MES ET DEL.

POLYCHROME FLOORS

BY HAROLD DONALDSON EBERLEIN AND ROGER WEARNE RAMSDELL

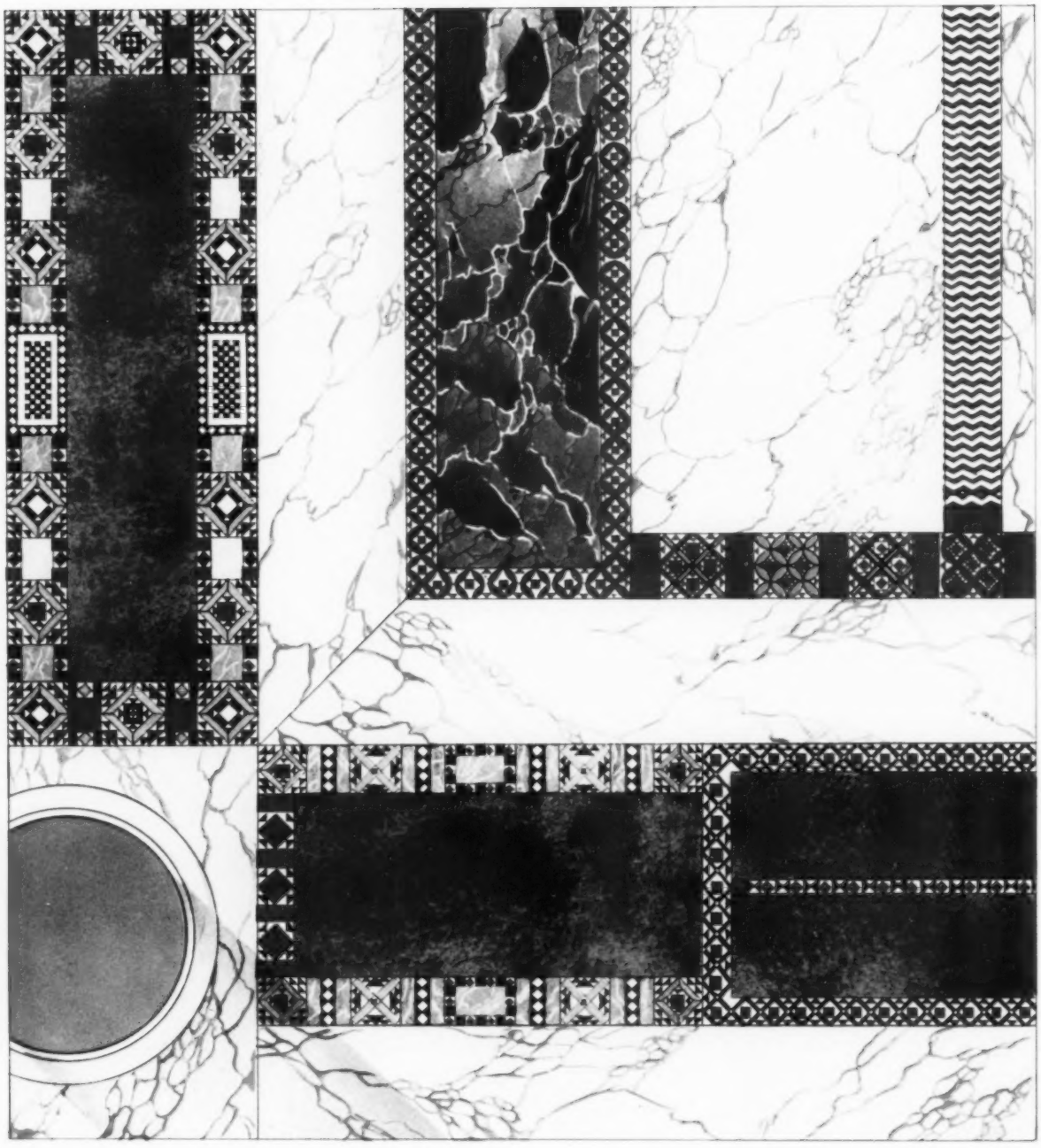
(Continued)

One of the earliest polychrome floors definitely recorded we find mentioned in the Book of Esther. The description of the palace of Ahasuerus tells us that there "were white, green, and blue hangings, festooned with cords of fine linen and purple, to silver rings and pillars of marble; the beds were of gold and silver, upon a pavement of red and blue and white and black marble." Whensoever, or by whomsoever, the Book of Esther may have been written, there can be little doubt that the writer was picturing the kind of floor more or less customary in the Persian palaces of the period.

Of several other very early decorated Eastern floors there are fortunately still extant enough remains for us to form some conception of what must have been the original splendor of the compositions to which they belonged. One of these examples is shown in the accompanying illustrations. It is a carved alabaster paving slab from the palace of Ashurbanipal and carries us back to about 650 B.C. In the British Museum there are three of these slabs in a fairly complete state of preservation, along with four or five much broken fragments that evidently formed part of another floor of similar character. The carving is vigorous and the pattern a bold, conventionalized design, partly geometrical, partly floriated. Whether the depressions were once filled with mastic, so that the whole surface of the paving would be smooth, or whether they were unfilled, so that the carved pattern remained in relief, cannot certainly be stated. The slabs are footworn and the edges of the pattern blunted by treading, but that may well have been because the mastic filling wore away quicker than the stone, got loosened and came out of its bed. Exactly the same condition of wear and bluntness of edges once clean cut exists in the carved medieval *dalles* of St. Omer wherever the mastic filling has disappeared, as it has in many instances.

Whether these alabaster floor slabs from Ashurbanipal's palace at Nineveh (Kouyunjik) were filled with vari-colored mastic, or whether the sinkages were merely colored and left unfilled, there can be little question that they were the vehicles of striking polychrome treatment. Indeed, they must have been in order to maintain any consistency or balance with the sculptured wall decoration, for all the mural sculptures of these chambers, when first excavated, indicated a scheme of brilliant polychromy, although nearly all traces of pigment soon fell away after exposure to the air. Nevertheless, it is still possible here and there to discover minute bits of remaining color. Some other carved alabaster paving slabs of the same period, discovered at Khorsabad, are in the Louvre.

Painted stucco, as a medium of floor polychromy, from its very nature seems too impermanent a substance to commend itself for either present experiment or emulation. Yet the instance of painted stucco floors, previously alluded to, carries our survey of multi-colored paving back to about 1400 B.C. These floor paintings on plaster were discovered by Sir W. M. Flinders Petrie in Egypt at Tell el Amarna. A line drawing of one of the floors is shown amongst the illustrations. The pavements, we are told, "were formed by laying a floor of mud bricks on the soil, covering them with a coat of mortar or fine concrete, about half an inch to an inch thick, so as to produce a level surface; and then facing that with fine plaster mixed with hair about one-eighth of an inch thick, on which the painting was executed. The colors were laid on while the plaster was wet, and even while it could still be moved with the brush. The long lines of the design were marked by stretching a string, and pressing it upon the still soft plaster. After painting, the whole surface was polished and water-proofed, as seen on a portion which was well protect-



MARBLE FLOOR IN HOSIOS LOUKAS MONASTERY. GREECE

. CORNER DETAIL .

ARCHITECTURAL RECORD SERIES.
POLYCHROME FLOORS
ANDRÉ LECONTE, MES ET DEL.

ed." . . . At one point there was "a small portion of a previous pavement, which had become worn, and was broken up to lay the present floor." Periodic renewal seems to have been expected where such floors were used.

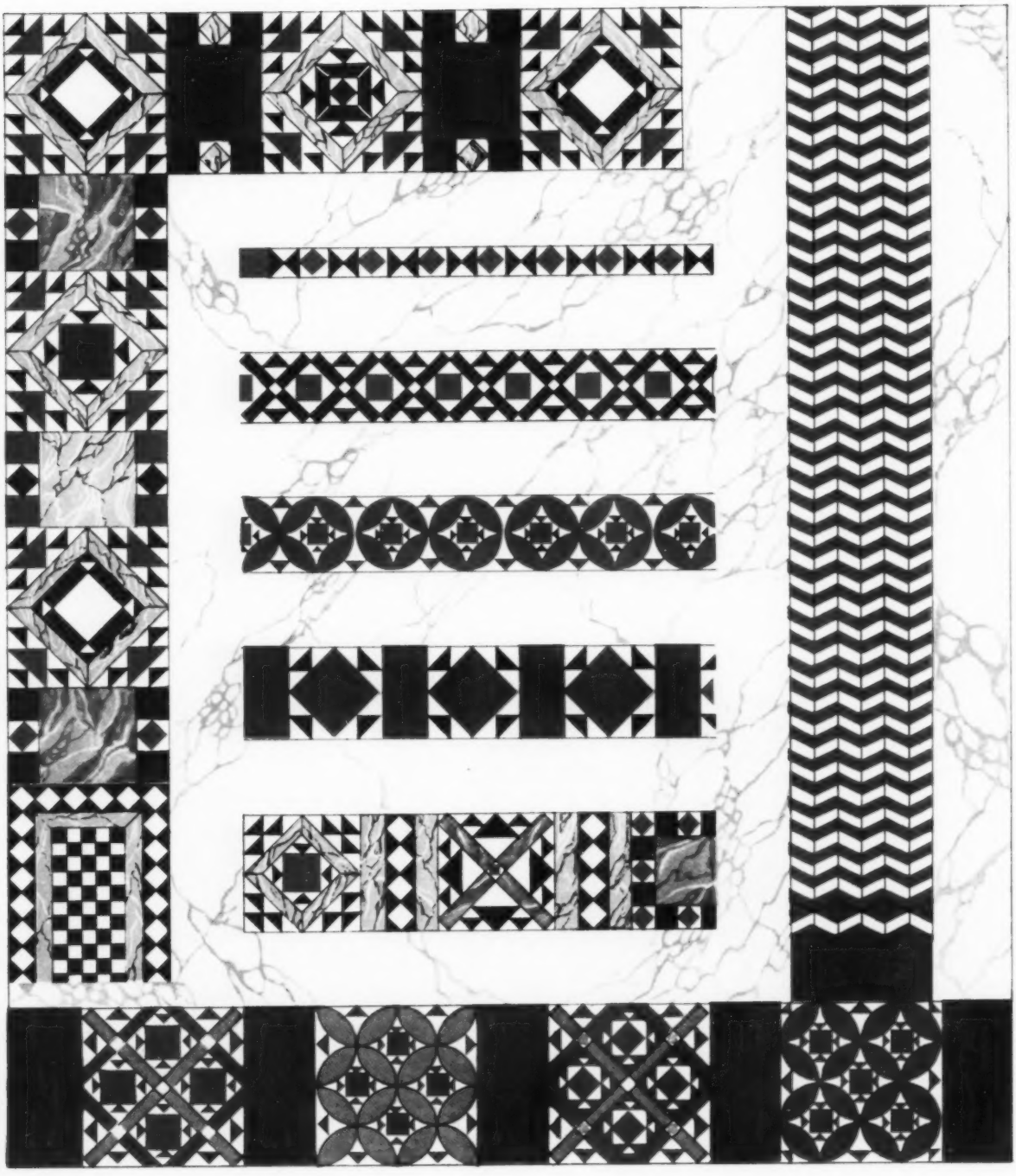
It is to be noted that the design contains no geometrical patterns and no conventionalized forms—save an approximation in the border—and that the treatment is thoroughly naturalistic to the full competency of Egyptian expression. The coloring, though spirited and varied, is generally soft in tone. A "black border, around the blue tank of fish and lotus, represents the black mud of the soil; whereas the plants have a yellow band beneath them indicating the sand." . . . "The colors used for this work are entirely mineral. The blues and greens are all of artificial frits . . . ; the reds are burnt yellow ochres, and the yellows are raw yellow ochres . . . ; and the black is doubtless soot, from the fineness of it. The use of half tints and shading off of the colors is frequent on the calves, the birds and the fishes." When seen in merely black and white, the pattern seems crowded, complex and not at all convincing; seen in color, the effect is altogether different, and the elements of the composition assume their true relative values. In other words, the color alone saves the day.

The only polychrome floors of antiquity of which we have satisfactory remains—in point of number, variety, or completeness of preservation—are the mosaic pavements. Of these good examples are to be found all the way from Asia Minor to England, and fresh specimens are coming to light from time to time. Furthermore, this method of paving has experienced such a common revival that everyone is reasonably familiar with its characteristics. Nevertheless, comparatively few people thoroughly realize the full range of polychrome effects of which mosaic paving is susceptible.

We shall do no more here than call attention to the terminology usually applied to various polychrome mosaic floors. The word *mosaic* indicates a pattern formed by fitting together many pieces of marble, opaque glass, colored clays or other substances, generally in small units. The classification of mosaic-work flooring includes (1) *opus tessellatum*, which consists of small cubes or *tesserae* of marble, stone, or baked clay, regularly set in simple patterns; (2) *opus vermiculatum*, which consists of cubes or *tesserae* of marble, stone, or baked clay, often necessarily of irregular shapes, so laid as to produce a pictorial effect, frequently of elaborate composition; (3) and *opus sectile*, which is a sort of marqueterie wrought in marble or other colored substances, so disposed as to produce pictures and patterns.

The *opus vermiculatum* is that branch of the mosaic art most commonly met with in classic antiquity, and most frequently seen in the modern revivals. An highly significant sub-division of the *opus sectile* is the *opus Alexandrinum*, so called from its reputed invention at Alexandria during the Roman period. It is generally composed of squares, roundels, lozenges and other shapes of red and green porphyry, in combination with a number of smaller units of marble or other substances, the whole floor being laid off in geometrical bands and borders of great diversity and often of intricate design.

Opus sectile was not only a favored form of floor decoration throughout many centuries, but was also to be found over a wide range of territory. Furthermore, it lent itself kindly to the most varied forms of expression in pattern and color alike. Starting with the popularity of the *opus Alexandrinum*, in that form and in related phases it recurs again and again until it reaches its climax of chromatic brilliance in the seventeenth century when the Italian *tarsiatori* ran the whole gamut of color with marble inlay cut adroitly in bold Baroque designs. For these creations they drew upon all the many-hued marbles of Italy, and supplemented their stone palette with importations of the rich quarries of northern Africa, as well as with supplies of malachite and lapis lazuli from a greater distance.



MARBLE FLOOR IN HOSIOS LOUKAS MONASTERY. GREECE

DETAILS. SCALE 1/6.

ARCHITECTURAL RECORD SERIES.
POLYCHROME FLOORS
ANDRÉ LECONTE, MES ET DEL.

THE ARCHITECTURAL RECORD

AN ILLUSTRATED MONTHLY MAGAZINE OF ARCHITECTURE & THE ALLIED ARTS & CRAFTS

VOLUME 67 APRIL · 1930 NUMBER 4

THE NEW SCHOOL FOR SOCIAL RESEARCH, NEW YORK CITY

JOSEPH URBAN, ARCHITECT

BRINGING LIGHT INTO CLASSROOMS

One of the main problems of the low city building is to secure the maximum of exterior light. To this end the walls of all classrooms facing the street are of glass. A horizontal scheme of fenestration permits of a wider, more even distribution of light in the interior. To extend the penetration of light further into the rooms the parapets at the floor levels are cantilevered, and the glass is continued as part of the partitions up to the piers.

•

DESIGN SCHEME

On the exterior the cantilever construction reaches a clarity of expression undisturbed by any apparent connection of supporting solids. The scheme in design is that of a succession of horizontals encasing a composite, vertical space. The color is black enframing a creamy, white mass. Black is carried through the white mass in horizontal bands the width of the structural unit, which is brick. This further repetition of a horizontal component in the vertical mass not only emphasizes the structural material but also reaches the entire scheme of the facade. It is the conception carried to its minutest detail.

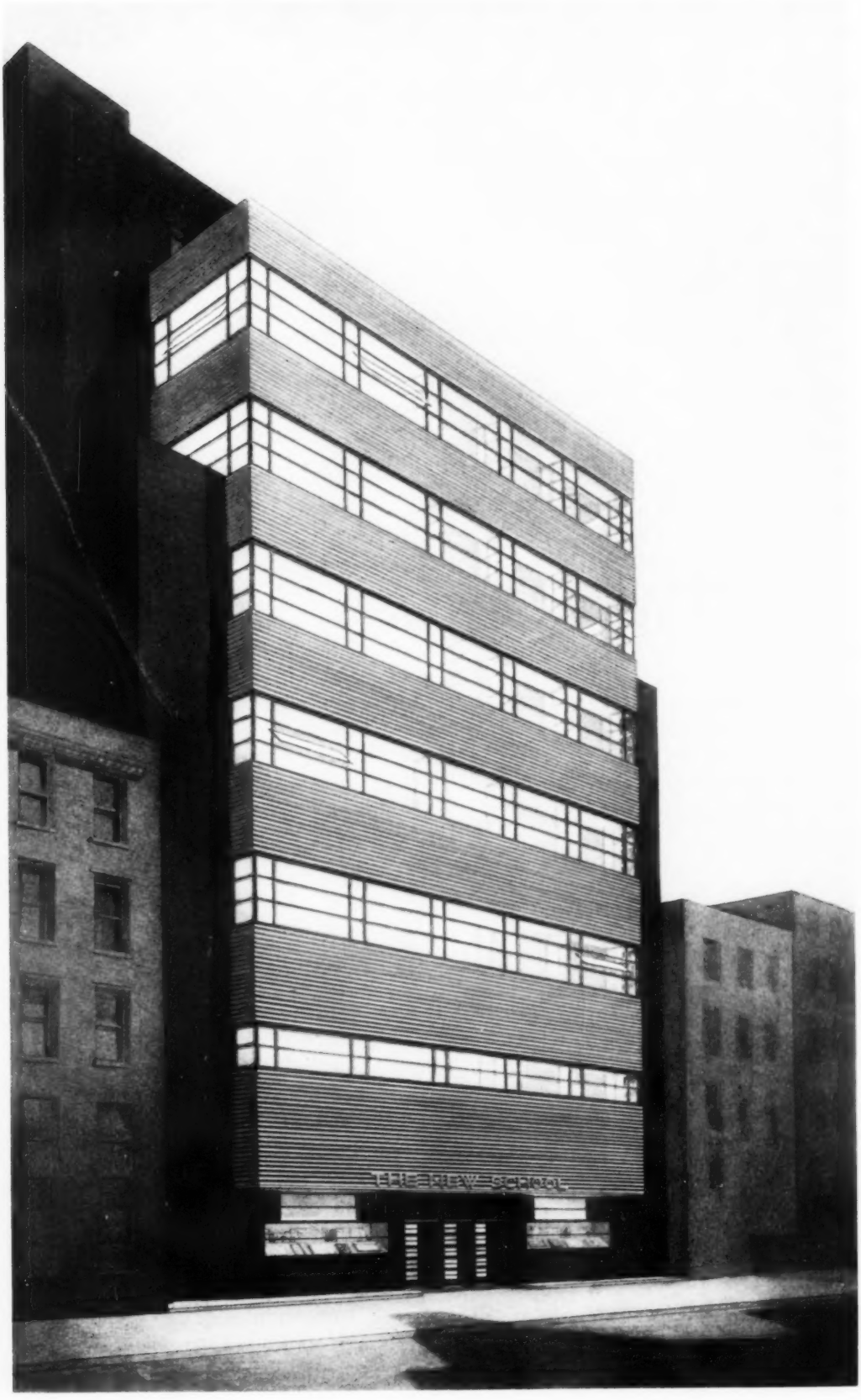
PLAN DISTRIBUTION

The study niches are on a mezzanine back of the auditorium. On the facade they are expressed by higher placing of the windows than elsewhere. The room is shallow. Wall space for charts and maps is a necessity, distraction from outside is undesirable. The room is kept as an open unit of space divided near the level of the eye into groupings for four or five persons. The atmosphere of intimacy of discussion is contrived without the disadvantage of the closeness of small rooms. It is also possible for a single speaker to command all the groups at one time.

•

AUDITORIUM

The auditorium is planned for maximum visibility and audibility for the greatest practicable number of persons seated on one level. Furthermore the variability of its use as theatre, lecture and concert hall necessitates corresponding flexibility of character. This is effected by foregoing any decorative scheme other than the special proportion of the room and the manner of illumination. Light sources are concealed in the concentric ribs of the vault and illuminated toward the stage. In the ribs over the auditorium and away from the stage are placed the air vents.



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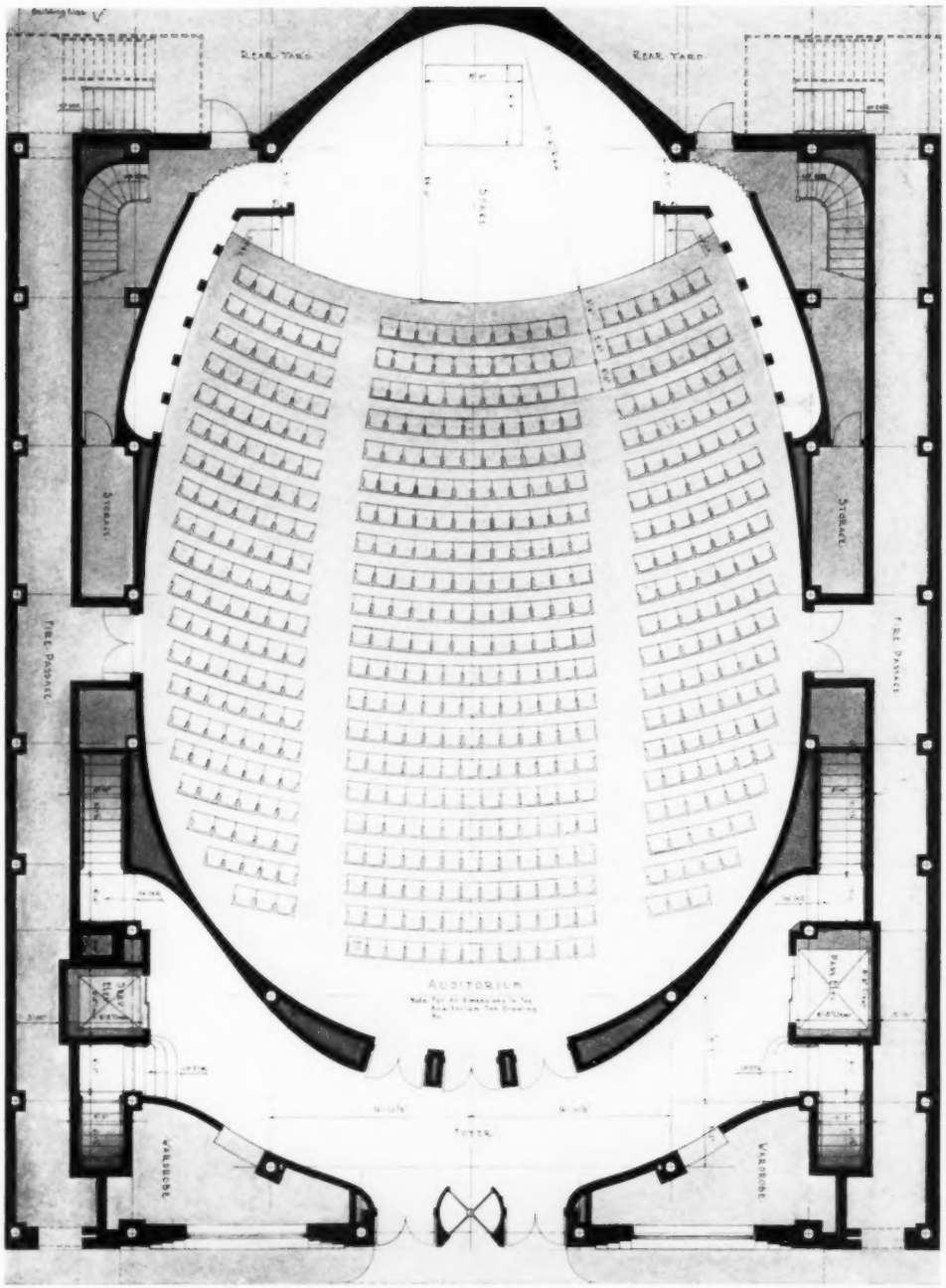
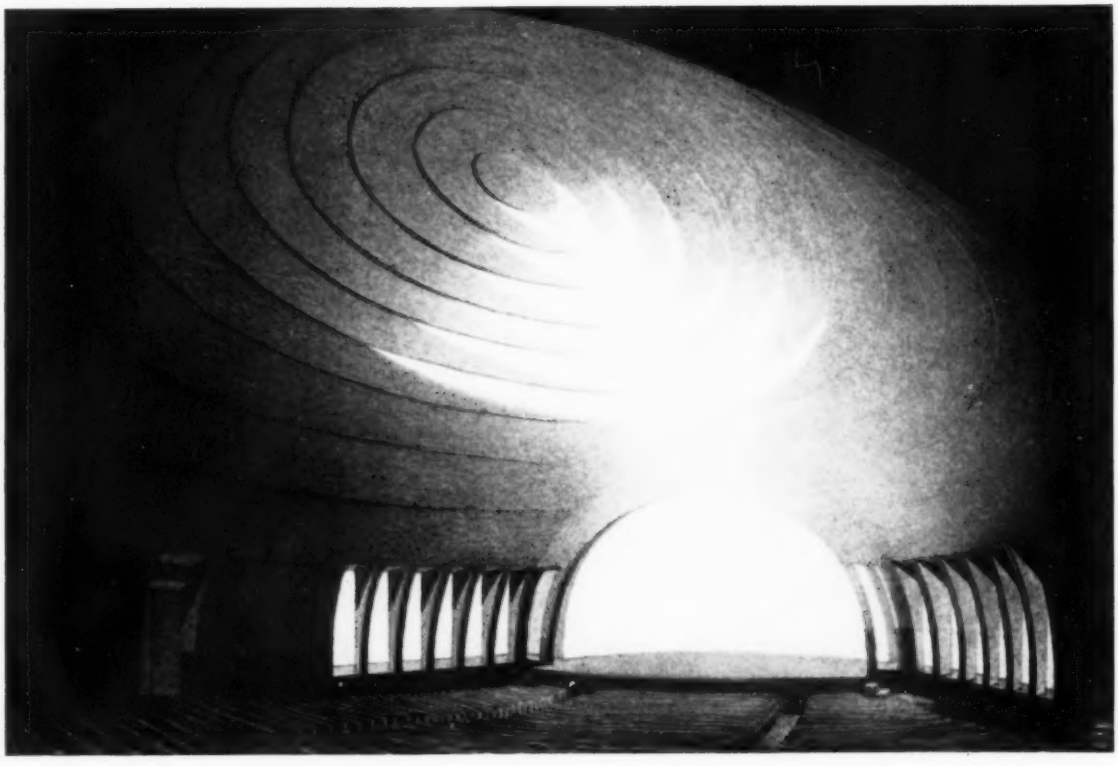


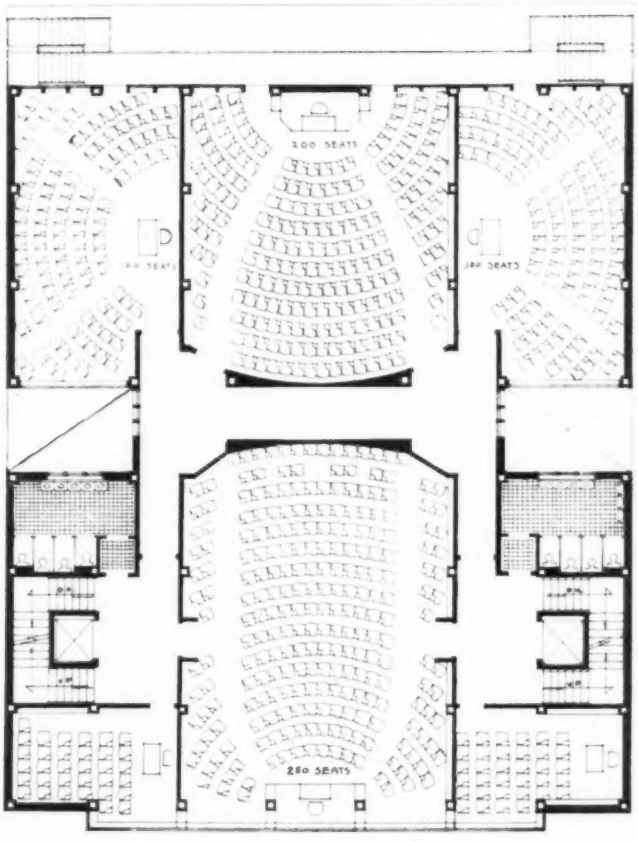
PLAN OF MAIN AUDITORIUM
NEW SCHOOL FOR SOCIAL RESEARCH
NEW YORK CITY
JOSEPH URBAN, ARCHITECT

With the stage cut off from the auditorium by screens, the apron becomes a speaking rostrum. The speaker is enclosed within the walls of the room occupied by the audience. Or, with the stage in operation, the action can spread along side wings and partially encircle the audience. The variety of mood and effect made possible by modern lighting within this simple shell is incalculable. At the present time it is difficult to imagine a more chaste solution of varied conditions and one more inspiring to a development of new dramatic technique, than the auditorium of the New School for Social Research.

SHEPARD VOGELGESANG.



MAIN AUDITORIUM



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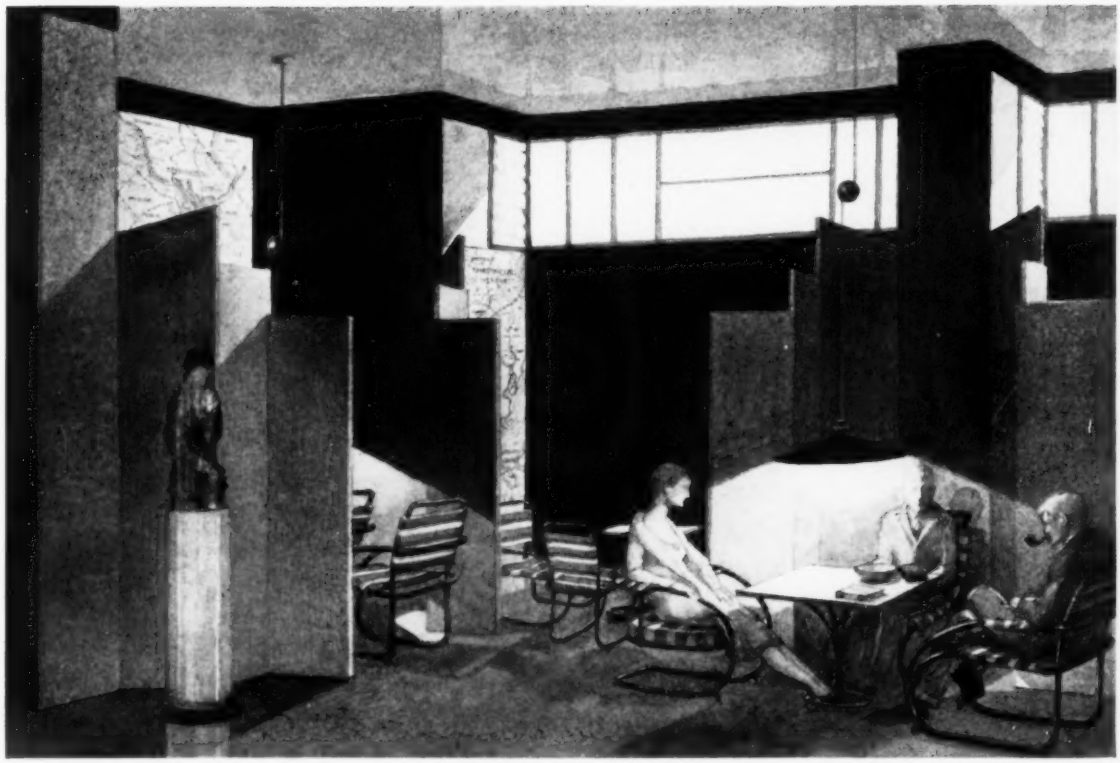
NEW YORK CITY

JOSEPH URBAN, ARCHITECT

PLAN OF SECOND FLOOR



"TALK-OVER" NICHES ON MEZZANINE FLOOR

NEW SCHOOL FOR SOCIAL RESEARCH
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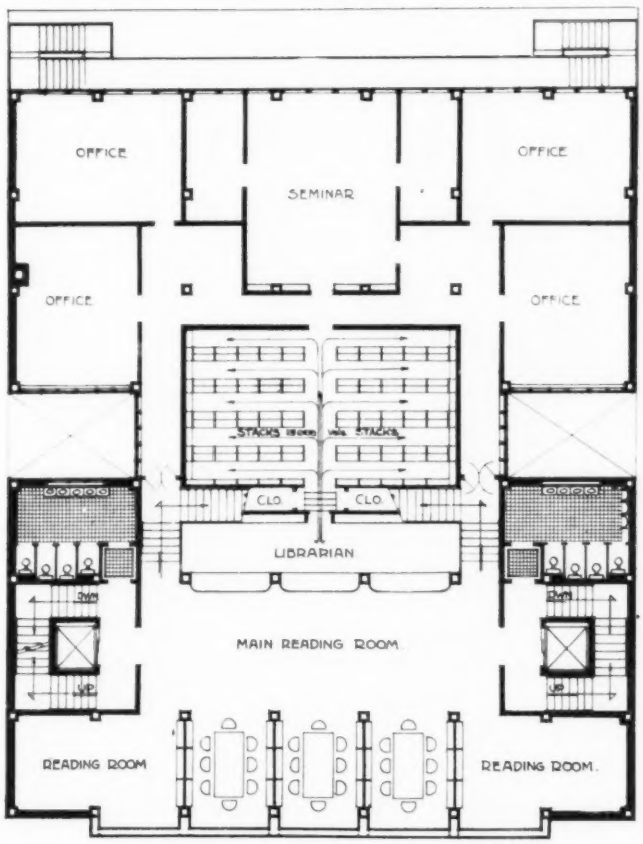
JOSEPH URBAN, ARCHITECT



PLAN OF FOURTH FLOOR

THE CAMDEN, N. J., CITY HALL PLAN

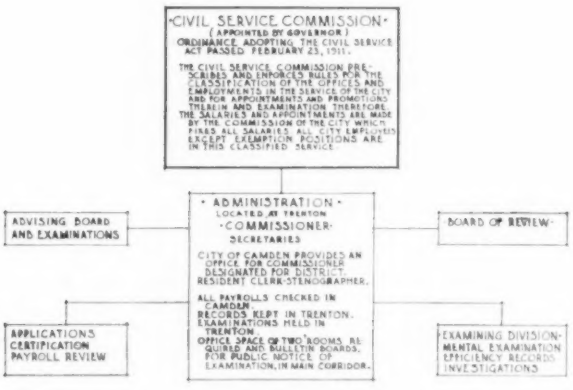
EDWARDS AND GREEN, INC., ARCHITECTS

An unusual preliminary survey conducted by Professors Warren Powers Laird and Lewis F. Pilcher

BY ARTHUR T. NORTH

THE commission form of city government is a marked change from the prevailing form, and a city hall designed for the new condition is of architectural interest. When the method used for developing the plan for a suitable city hall is unusual, the interest is further increased. Such an instance is that of the recent action of the City of Camden, New Jersey.

The commission form of city government was adopted by Camden in 1923 and the new form of government was set up in the existing city hall. This building was entirely inadequate for the purpose. The commission, June 1928, authorized a survey and recommendations for the location and the requirements for a new city hall. It retained Professor Warren Powers Laird, University of Pennsylvania, for that purpose. On his request Professor Lewis F. Pilcher, University of Pennsylvania—former State Architect of New York—was associated in the work.


CIVIL SERVICE COMMISSION
(APPOINTED BY GOVERNOR)
ORDINANCE ADOPTING THE CIVIL SERVICE ACT PASSED FEBRUARY 25, 1911.
THE CIVIL SERVICE COMMISSION PRESCRIBES AND ENFORCES RULES FOR THE CLASSIFICATION OF THE OFFICES AND EMPLOYMENTS IN THE SERVICE OF THE CITY AND FOR APPOINTMENTS AND PROMOTIONS THEREIN AND EXAMINATION THEREFORE. THE SALARIES AND APPOINTMENTS ARE MADE BY THE COMMISSION OF THE CITY WHICH FIXES ALL SALARIES. ALL CITY EMPLOYES EXCEPT EXEMPTION POSITIONS ARE IN THIS CLASSIFIED SERVICE.
ADMINISTRATION
LOCATED AT TRENTON
COMMISSIONER
SECRETARIES
CITY OF CAMDEN PROVIDES AN OFFICE FOR COMMISSIONER DESIGNATED FOR DISTRICT RESIDENT CLERK STENOGRAPHER.
ALL PAYROLLS CHECKED IN CAMDEN.
RECORDS KEPT IN TRENTON.
EXAMINATIONS HELD IN TRENTON.
OFFICE SPACE OF TWO ROOMS, REQUIRED AND BULLETIN BOARDS, FOR PUBLIC NOTICE OF EXAMINATION, IN MAIN CORRIDOR.
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PLANS FOR CIVIL SERVICE COMMISSION

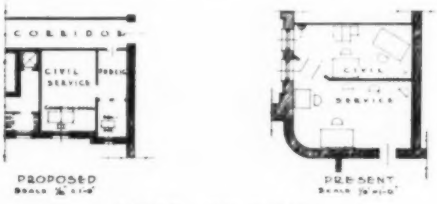


CHART AND PLANS

CAMDEN, N. J., CITY HALL

EDWARDS AND GREEN, INC., ARCHITECTS

The plan (left, below) incorporates the actual needs of the department in question, as ascertained through the analysis indicated by the chart (above)

These gentlemen had previously made a similar survey and recommendations for the Board of Freeholders of Camden County pertaining to a new court house annex which was to be constructed on a portion of a city block adjacent to the court house, the site owned by the county. After a survey of the local conditions appertaining to the city hall problem, it was recommended that the city condemn and acquire title to the balance of the city block and build a city hall jointly with the court-house annex. The unoccupied portion of the property is intended to be utilized as a plaza, appropriately parked. It was also recommended that a small triangular city block contiguous to the proposed plaza be condemned to increase it. An underground bus terminal is also to be constructed under the plaza. These recommendations are particularly appropriate to the street traffic conditions which are affected by the great volume of vehicular traffic originating at the nearby Delaware River Bridge Plaza. The recommendations were accepted and the necessary legislation enacted.

An understanding of the nature and scope of the survey and recommendations, the labor required for research, analysis and planning, and its function in a rational method of procedure is best obtained through a detailed description of the production process.

Following the survey of the local conditions which determined the location of the new city hall, a study was made of the city charter and the state commission government law of 1917. This analysis was recorded in the form of charts. These charts indicate the sources of authority, the functions of every constituent bureau, and the personnel and equipment required for its operation.

The basic or "key" chart describes the organization of the board of commissioners, which elects one of its members to be mayor. It has authority to legislate, adjudicate and administer all affairs of the city of Camden. Each bureau or activity is allocated to one of the five departments prescribed by law, and each of the commissioners is assigned as a director of a department. The mayor is ex-officio director of the Department of Public Affairs. The five departments and their constituent bureaus are:

I. Department of Public Affairs
- City Clerk
- City Counsel
- Bureau of Health
- Bureau of Charities

II. Department of Revenue and Finance
- Comptroller
- Receiver of Taxes
- Board of Assessors
- Purchasing

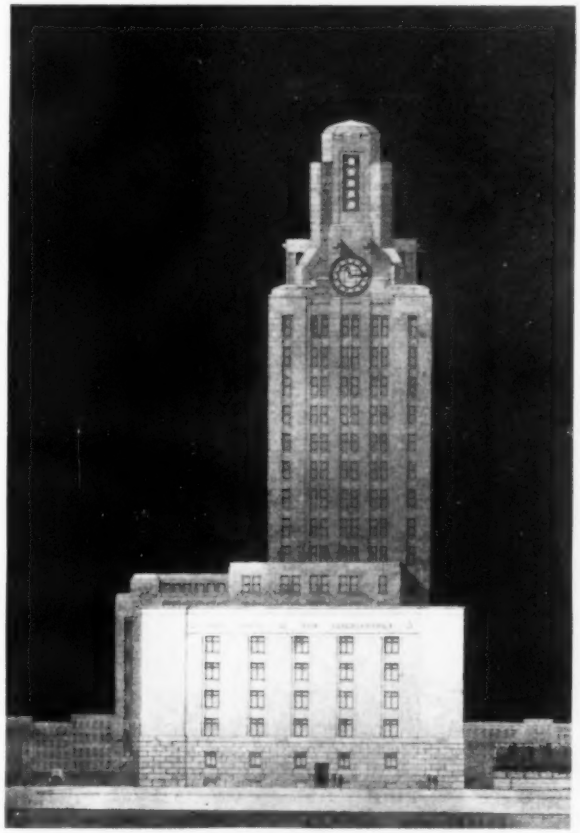
III. Department of Public Safety
- Police Dep't.
- Fire Department
- Recorder's Court
- Weights and Measures
- Electrical Bureau
- Building Inspector
- Plumbing Inspector

IV. Department of Streets and Public Improvements
- Water
- Sewers
- Streets
- Municipal Construction

V. Department of Parks and Public Property
- Bureau of Audit and Accounts
- Bureau of Parks
- Bureau of Public Property

In addition to the five departments, the city provides quarters for the Civil Service Commission, the Public Utilities Commission and the District Court, appointed by the governor, and the Board of Education, appointed by the mayor.

Three kinds of charts were made—organization of the board of commissioners, organization of each department, and organization of each department constituent bureau. Each of the five department charts describes the functions of its commissioner-director, the headquarters personnel and also in general each constituent bureau.



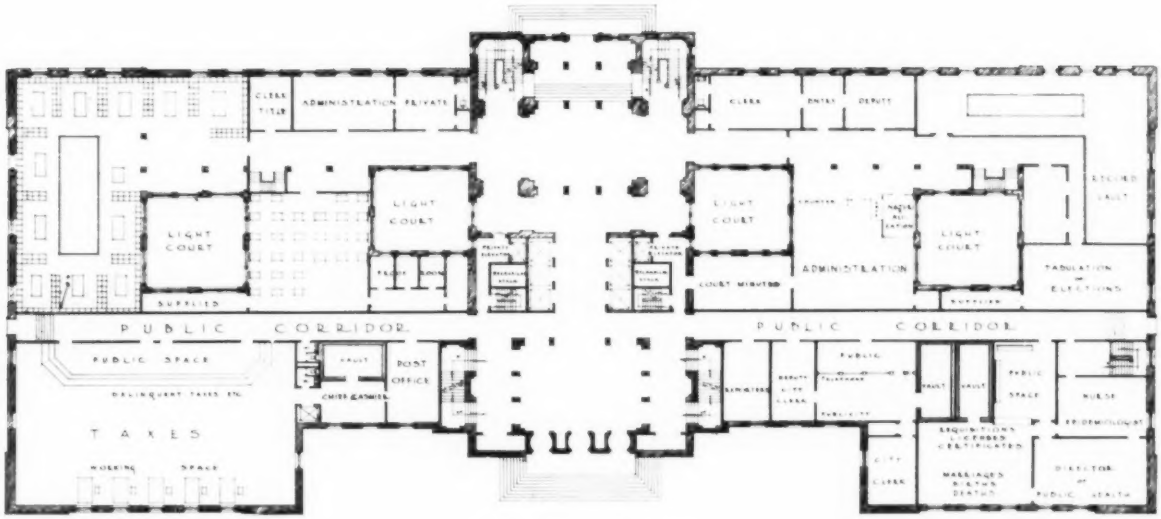
RENDERING

CAMDEN, N. J., CITY HALL

EDWARDS AND GREEN, INC., ARCHITECTS

Each bureau chart describes in detail its responsible director, its functions, personnel and working requirements. These charts visualize the complete scheme of city government, the relations of each bureau to the others severally and jointly. These relationships to the city government and the nature of its contacts with the public were the controlling factors in determining the location and plan of each bureau quarters.

The working routine, methods, processes and equipment of each bureau were studied.



PLAN OF MAIN FLOOR

CAMDEN, N. J., CITY HALL

EDWARDS AND GREEN, INC., ARCHITECTS

The chief considerations were those of efficiency and convenience, not of axes and imposing entrances

A detailed plan of its present quarters was made showing the rooms, location of furniture and equipment. Data were procured and studied pertaining to the relation of work required to the population.

Based on these data and the conclusions formed, a plan was made for housing each bureau in the new city hall with provisions for the inevitable increase in population and public business. In making these tentative plans the city bureau was considered in its plan aspect as a place in which to conduct the public business in the most convenient and efficient manner. This involved providing light, ventilation, suitable working spaces, convenient public spaces, vaults, private offices and other features appertaining to the particular governmental unit. A comparison of the new and the existing plans discloses the utter lack of scientific planning of the present quarters.

It was recommended to convert the present city hall into a general police headquarters and city jail. Detailed plans were made of the building with its equipment. Tentative plans were made for its use as police headquarters and jail.

Plans were made showing the units assembled in a building used as a joint city hall and court house annex. The various bureaus are located in accordance with their contacts with the public—convenience being the first requirement. Each commissioner as such and as a department director has offices which occupy an entire floor of the tower portion of the building which belongs to the city.

Both buildings have the elevators, the elevator lobbies, the heating and power plant in common; otherwise they are separated by an unbroken wall, each building having its own circulation corridors. Provisions are made in the upper parts of the tower for a municipal broadcasting station, a carillon, a four-face tower clock and beacon lights and electrical impulses for the guidance of aviators.

The joint county-and-city building is very simple in design. It will be a dignified and impressive building. All exposed surfaces of the exterior walls are faced with a gray granite. The granite is secured from two widely separated quarries, each providing one-half of the required quantity. There is no apparent color or texture

difference which distinguishes one from the other. This division of the granite contract insures delivery of the material as needed.

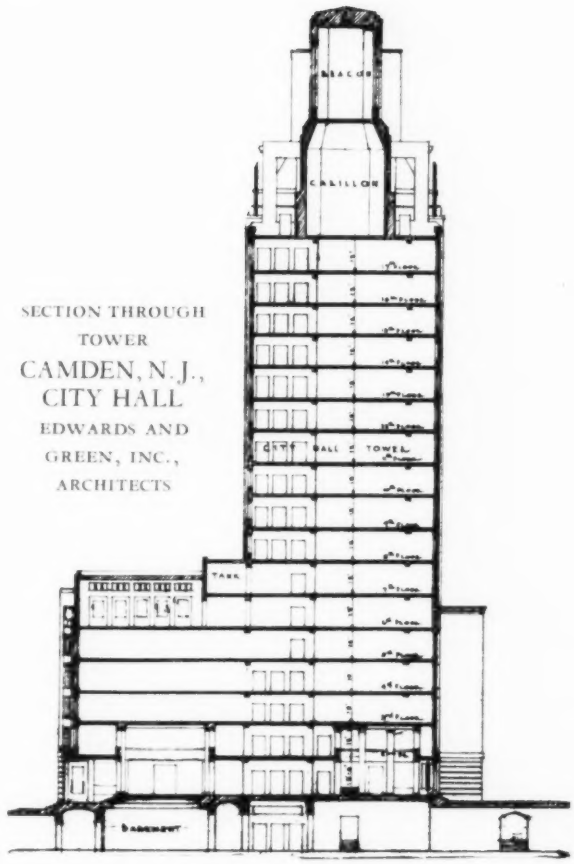
The county survey was authorized November 1927, the city survey June 1928. The contract for test borings was let June 1928; contracts for foundations let October 1928; general contract, complete, let April 1929; completion of the structure June 1930. The contract prices did not exceed the estimated costs included in the surveys.

The Board of Freeholders of Camden County and City Commissioners of Camden retained Edwards and Green, Inc., architects, and Professor Lewis F. Pilcher, associate architect, to prepare the plans and supervise the construction of the building.

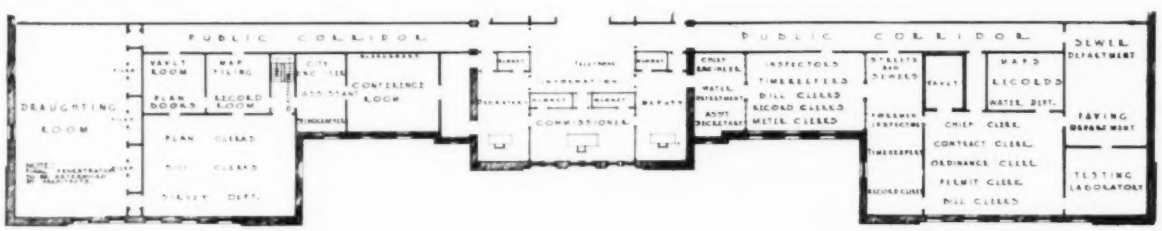
This is an instance of an unusual method employed in the planning of public buildings. It is a distinct departure from the usual program of architectural competitions for public buildings in which an "architectural advisor" sets up the program of requirements. In this case the consultants prepared 6 maps, 22 organization charts, 15 combined old and new bureau plans, 17 assembled floor plans—a total of 60 sheets of maps, charts and plans. In addition there were submitted tentative elevations, a section and perspective of the building showing its relation to the proposed plaza, and a comprehensive written report.

The volume of work and the intensive study given to the project by the consultants and the cooperation given by the officials is unprecedented, but justified by the results. The primary importance of the plan is demonstrated with the architectural design of the exterior and public lobbies as of secondary importance. The architectural design was evolved from the plan in a logical manner.

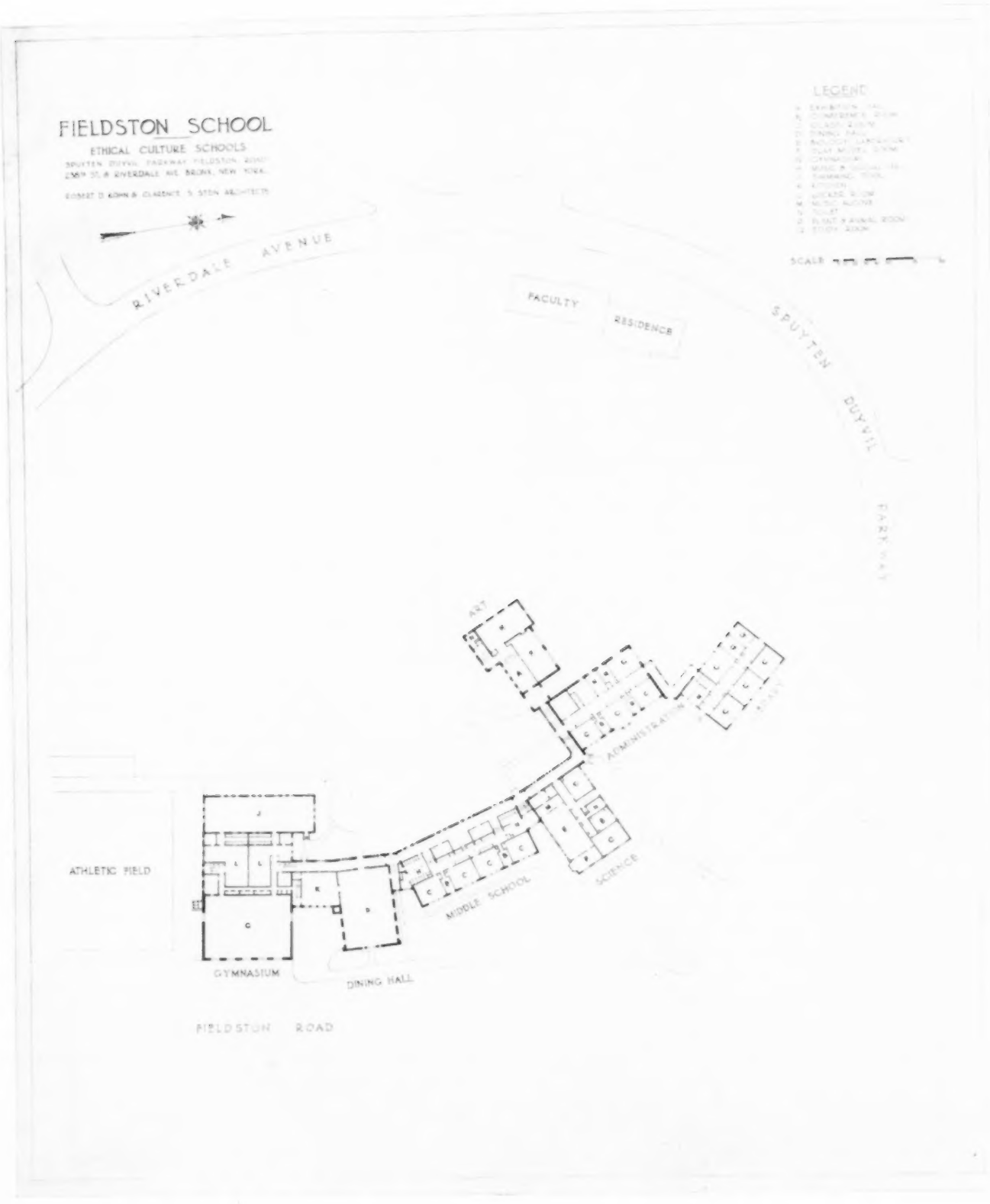
The studies of street traffic, plans for its routing, the underground bus terminal and landscape treatment are in process.



SECTION THROUGH TOWER
CAMDEN, N. J., CITY HALL
EDWARDS AND GREEN, INC., ARCHITECTS



THE DEPARTMENT OF STREETS AND PUBLIC IMPROVEMENTS
CAMDEN, N. J., CITY HALL
EDWARDS AND GREEN, INC., ARCHITECTS



PLOT PLAN

FIELDSTON SCHOOL, RIVERDALE-ON-HUDSON, N. Y.

CLARENCE S. STEIN AND ROBERT D. KOHN, ARCHITECTS

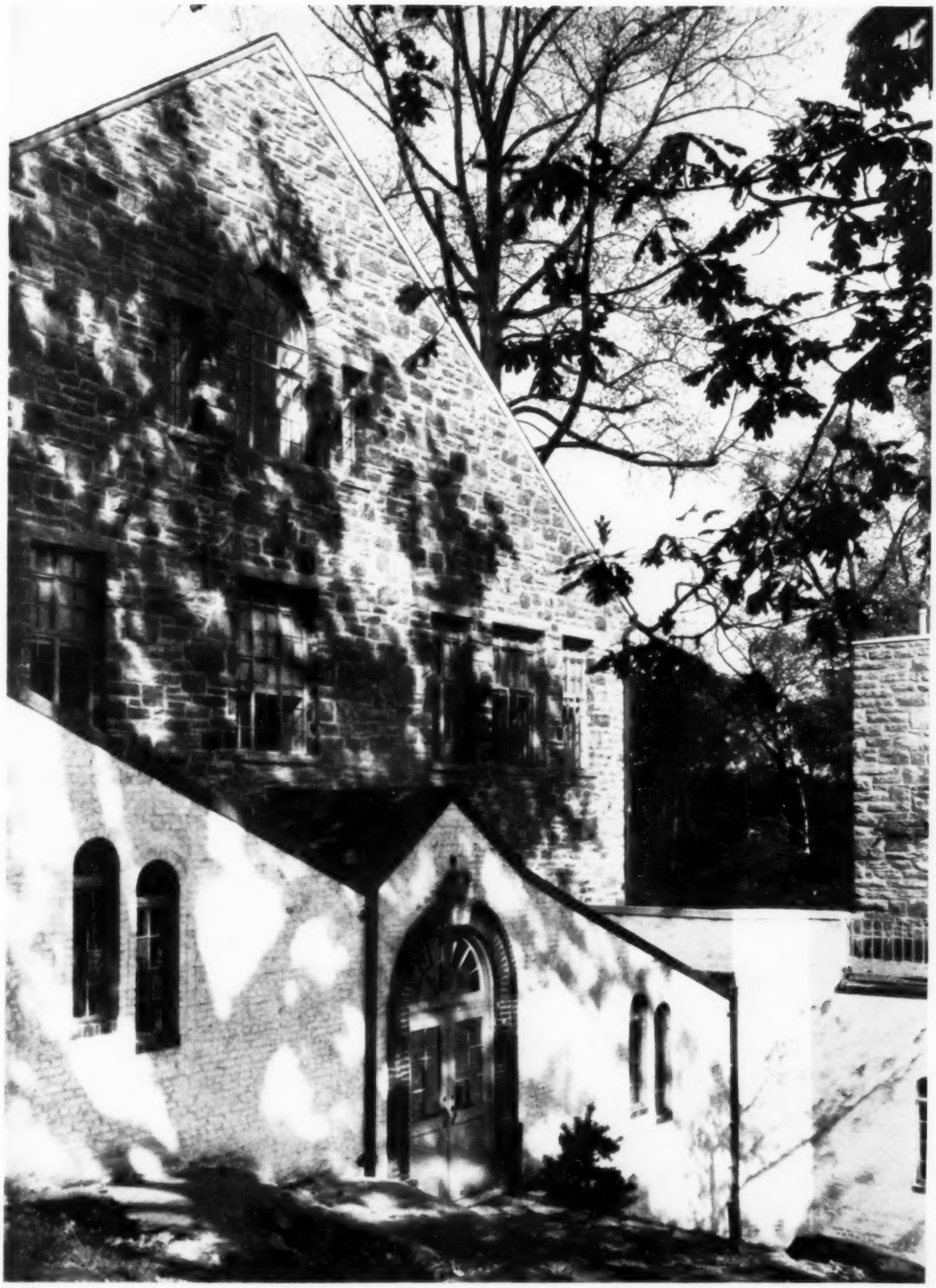


Photo. Grant

ENTRANCE TO ART BUILDING

FIELDSTON SCHOOL, RIVERDALE-ON-HUDSON, N. Y.

CLARENCE S. STEIN AND ROBERT D. KOHN, ARCHITECTS

Photo. Grant

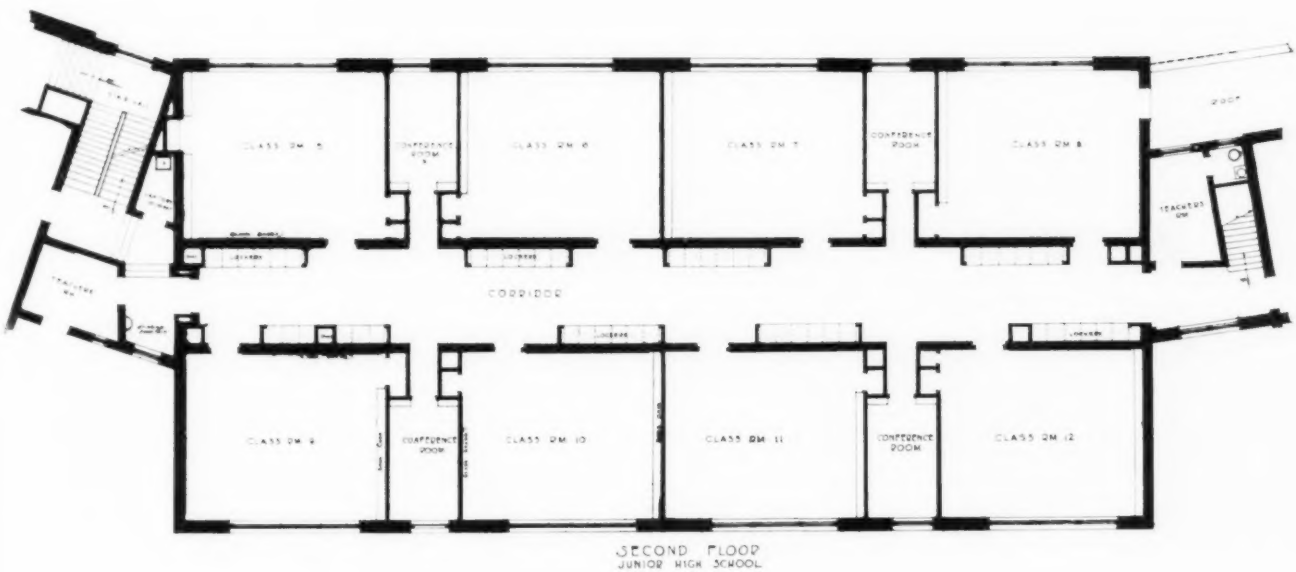
JUNIOR HIGH SCHOOL — SCIENCE

ADMINISTRATION LIBRARY

ABOVE, BOTH PAGES, PANORAMA

FIELDSTON SCHOOL, RIVERDALE-ON-HUDSON, N. Y.

CLARENCE S. STEIN AND ROBERT D. KOHN, ARCHITECTS



SECOND FLOOR
JUNIOR HIGH SCHOOL

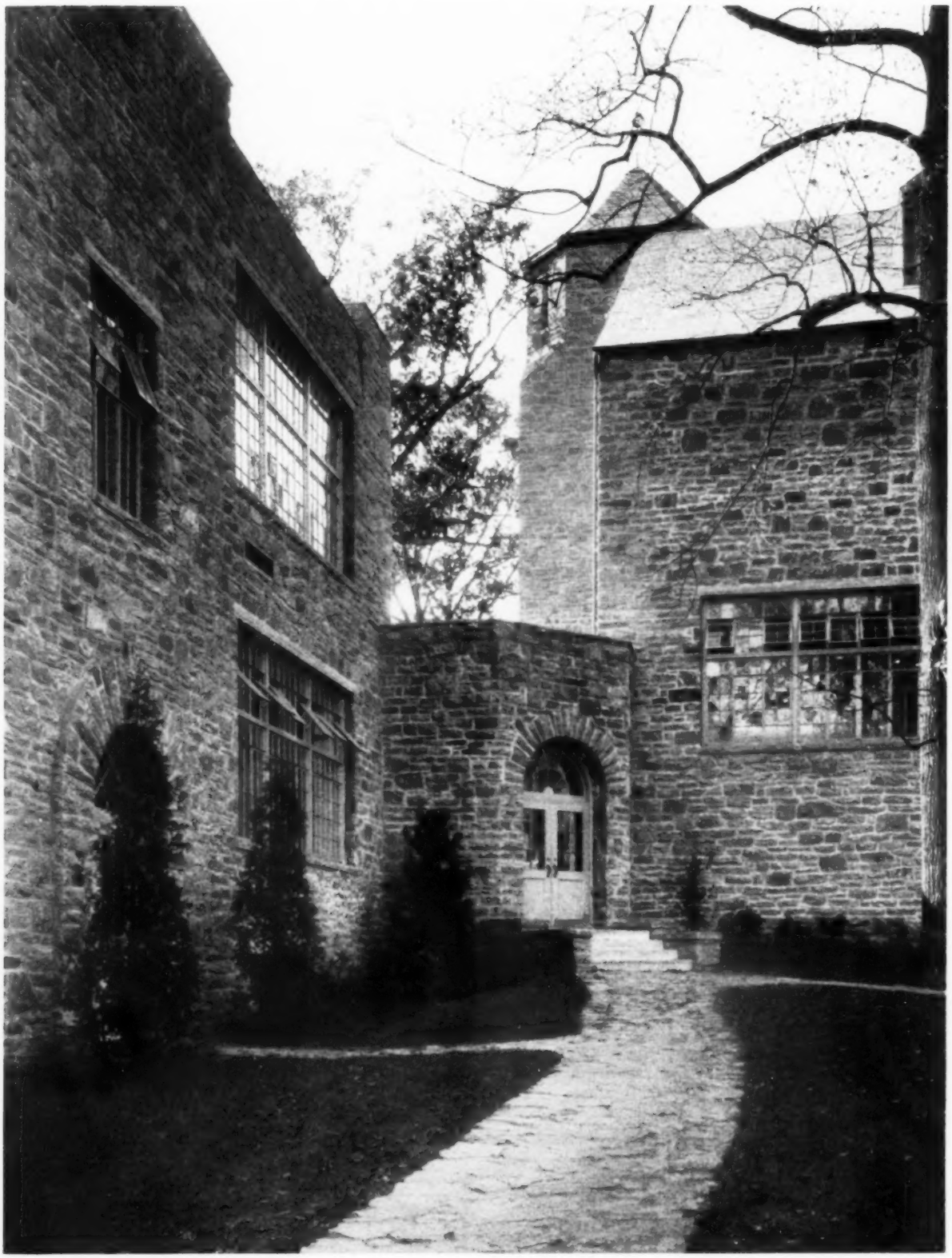


Photo. Grant

ENTRANCE TO ADMINISTRATION BUILDING
FIELDSTON SCHOOL, RIVERDALE-ON-HUDSON, N. Y.
CLARENCE S. STEIN AND ROBERT D. KOHN, ARCHITECTS

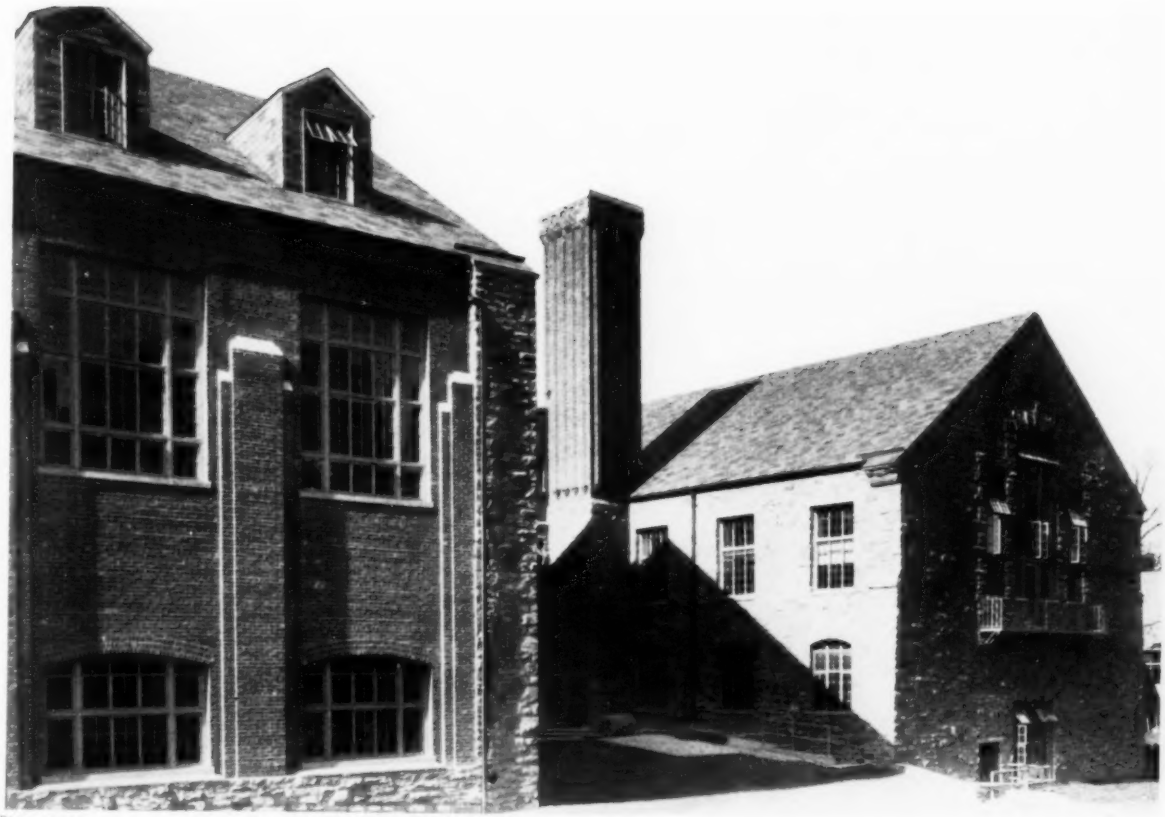
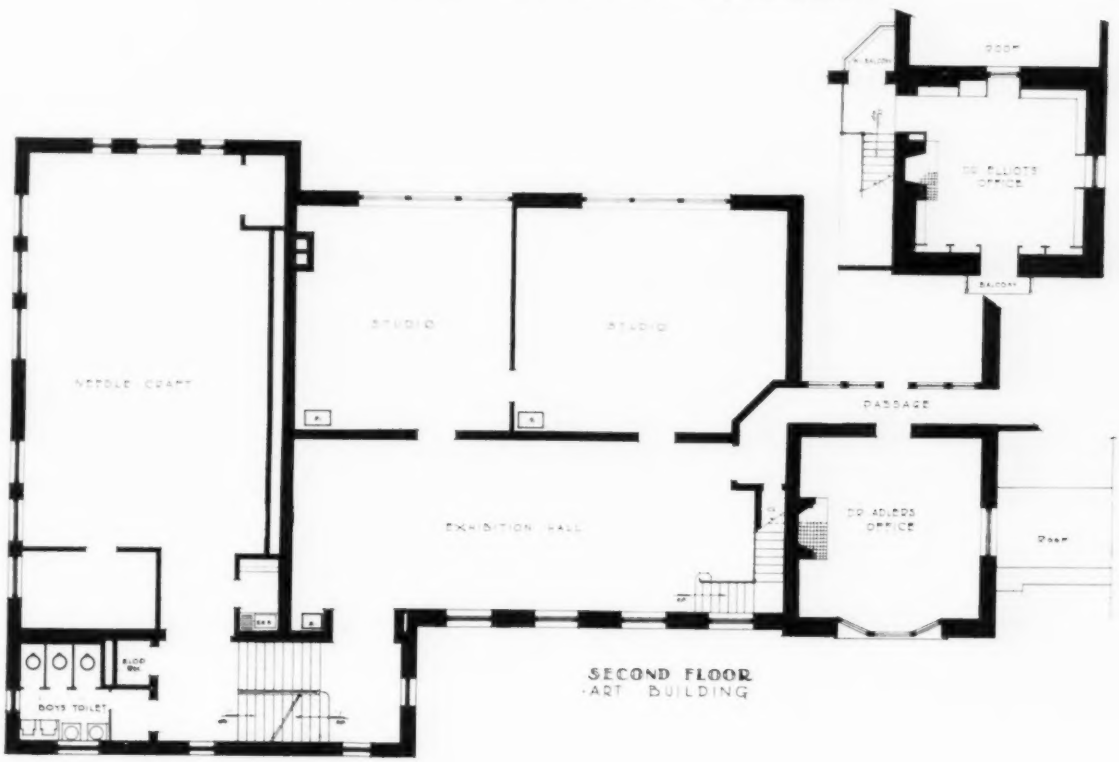


Photo. Grant

GYMNASIUM AND DINING HALL

FIELDSTON SCHOOL, RIVERDALE-ON-HUDSON, N. Y.

CLARENCE S. STEIN AND ROBERT D. KOHN, ARCHITECTS



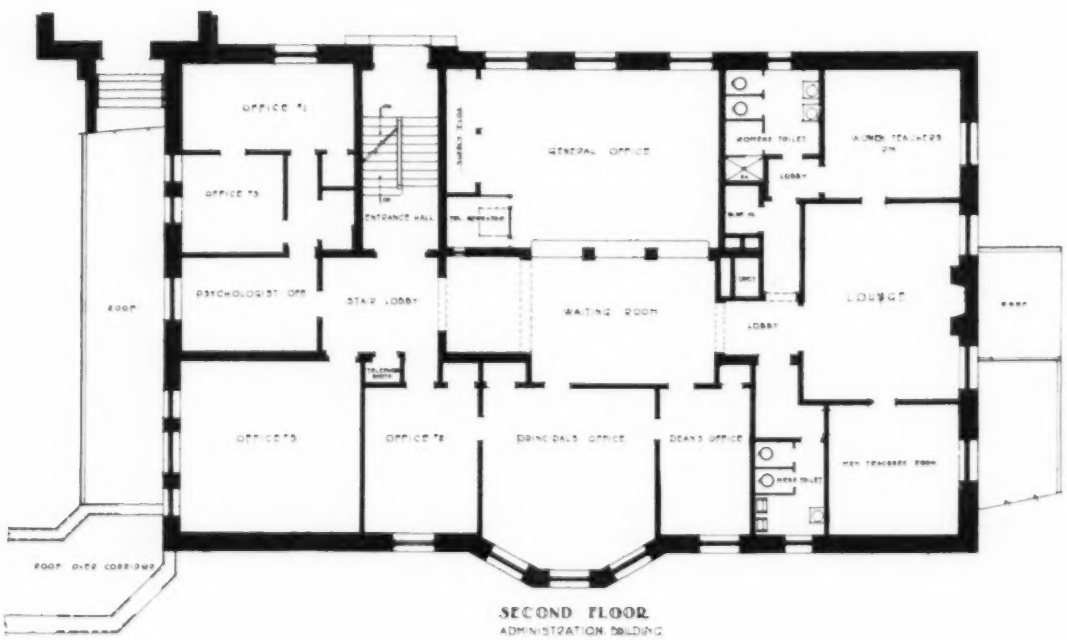
SECOND FLOOR
ART BUILDING

Photo. Grant

INTERIOR OF DINING HALL

FIELDSTON SCHOOL, RIVERDALE-ON-HUDSON, N. Y.

CLARENCE S. STEIN AND ROBERT D. KOHN, ARCHITECTS



SECOND FLOOR
ADMINISTRATION BUILDING

PORTFOLIO
OF
CURRENT ARCHITECTURE

Photo. Gottsche

ONONDAGA GOLF AND COUNTRY CLUB, FAYETTEVILLE, N. Y.
PEABODY, WILSON AND BROWN, ARCHITECTS

FEATURING
COUNTRY CLUBS
SMALL HOUSES

Photo. Gottscho

ONONDAGA GOLF AND COUNTRY CLUB, FAYETTEVILLE, N. Y.

PEABODY, WILSON AND BROWN, ARCHITECTS

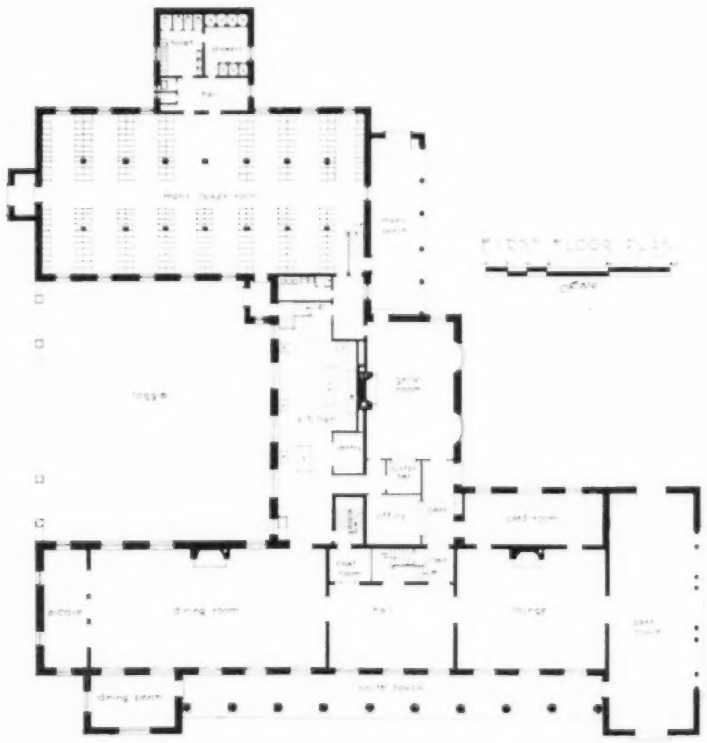


Photo. Gottscho

ONONDAGA GOLF AND COUNTRY CLUB, FAYETTEVILLE, N. Y.

PEABODY, WILSON AND BROWN, ARCHITECTS

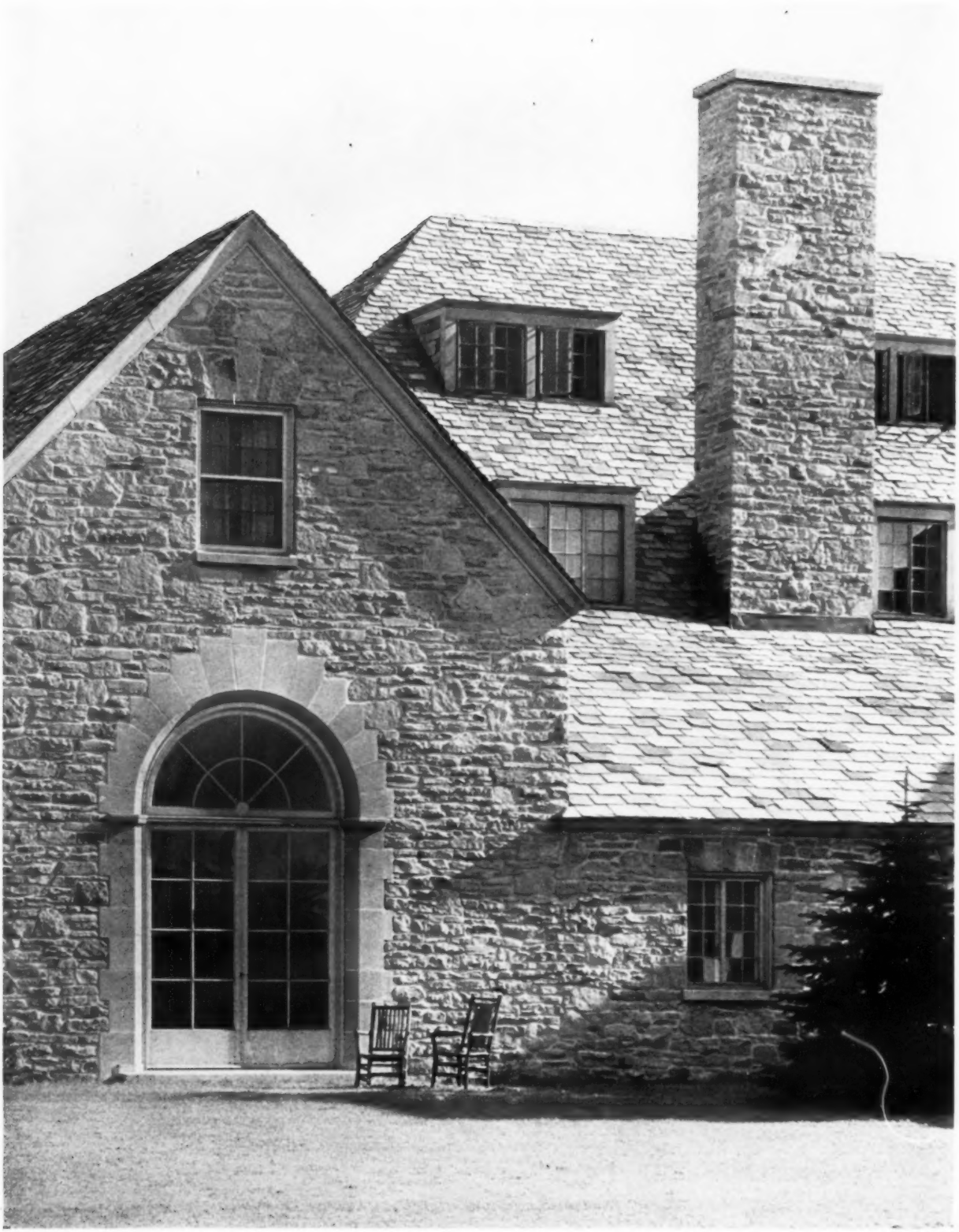


Photo Gottscho

ONONDAGA GOLF AND COUNTRY CLUB, FAYETTEVILLE, N. Y.

PEABODY, WILSON AND BROWN, ARCHITECTS

Photo. Gottscho

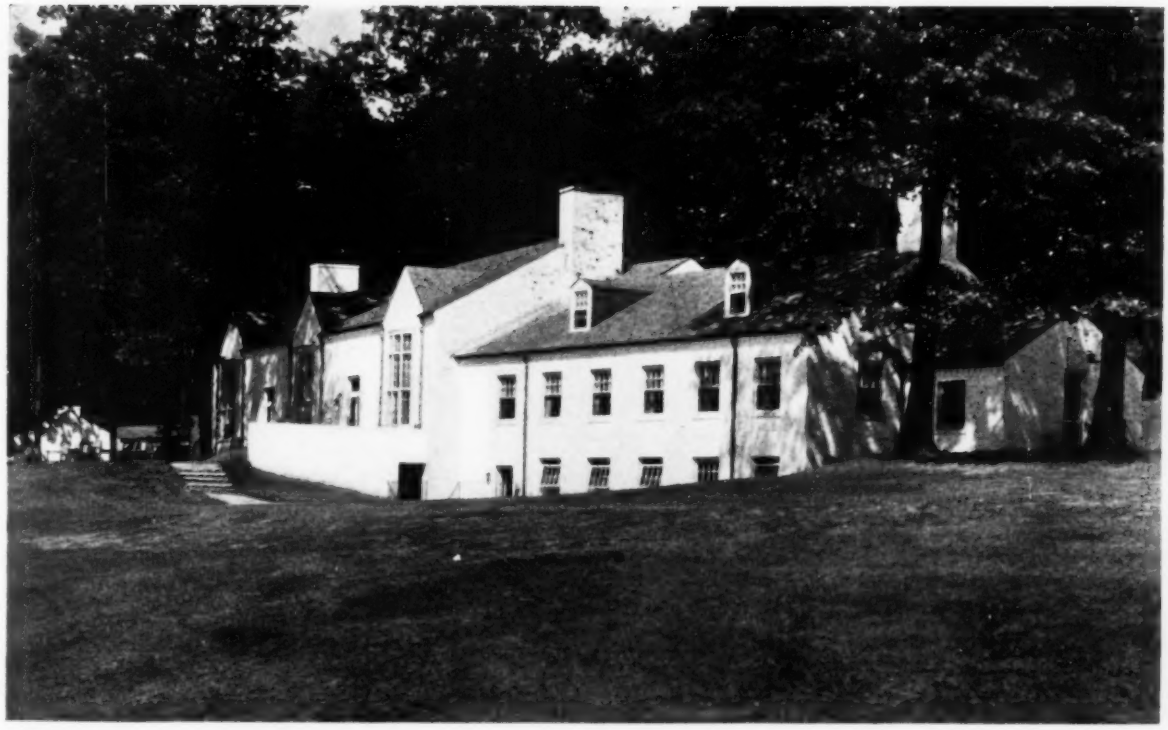
ONONDAGA GOLF AND COUNTRY CLUB, FAYETTEVILLE, N. Y.

PEABODY, WILSON AND BROWN, ARCHITECTS

Photo. Thompson

HOLSTON HILLS COUNTRY CLUB, KNOXVILLE, TENN.

BARBER AND MCMURRY, ARCHITECTS



GENERAL VIEW

Photo. Thompson

LOGGIO AND SHOP

HOLSTON HILLS COUNTRY CLUB, KNOXVILLE, TENN.

BARBER AND MCMURRY, ARCHITECTS

Photo. Thompson

LOUNGE

HOLSTON HILLS COUNTRY CLUB,
KNOXVILLE, TENN.

BARBER AND MCMURRY, ARCHITECTS

MAIN FLOOR PLAN

Plate Guilet

TERRACE

HOUSE OF MR. WALDRON FAULKNER, BRONXVILLE, N. Y.

WALDRON FAULKNER, ARCHITECT

Photo. Gillies

ENTRANCE

HOUSE OF MR. WALDRON FAULKNER, BRONXVILLE, N. Y.

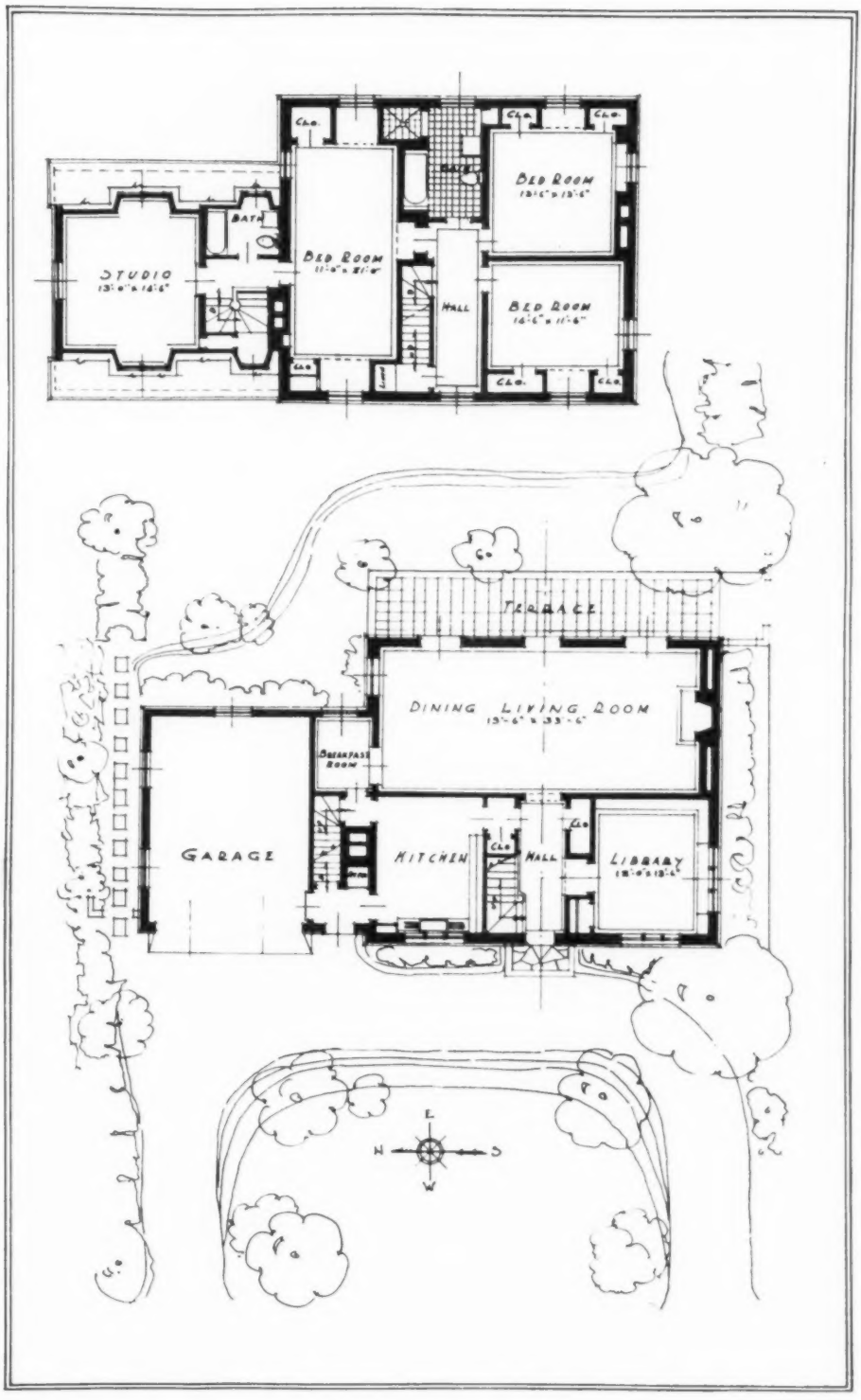
WALDRON FAULKNER, ARCHITECT

Photo, Gillies

FIREPLACE, OWNER'S ROOM

HOUSE OF MR. WALDRON FAULKNER, BRONXVILLE, N. Y.

WALDRON FAULKNER, ARCHITECT



PLANS

HOUSE OF WILLIAM A. KITTREDGE, EVANSTON, ILL.

A. ERWIN NICOLAI AND RALPH E. STOETZEL, ARCHITECTS

Photo. Gerlach

VIEW FROM GARDEN

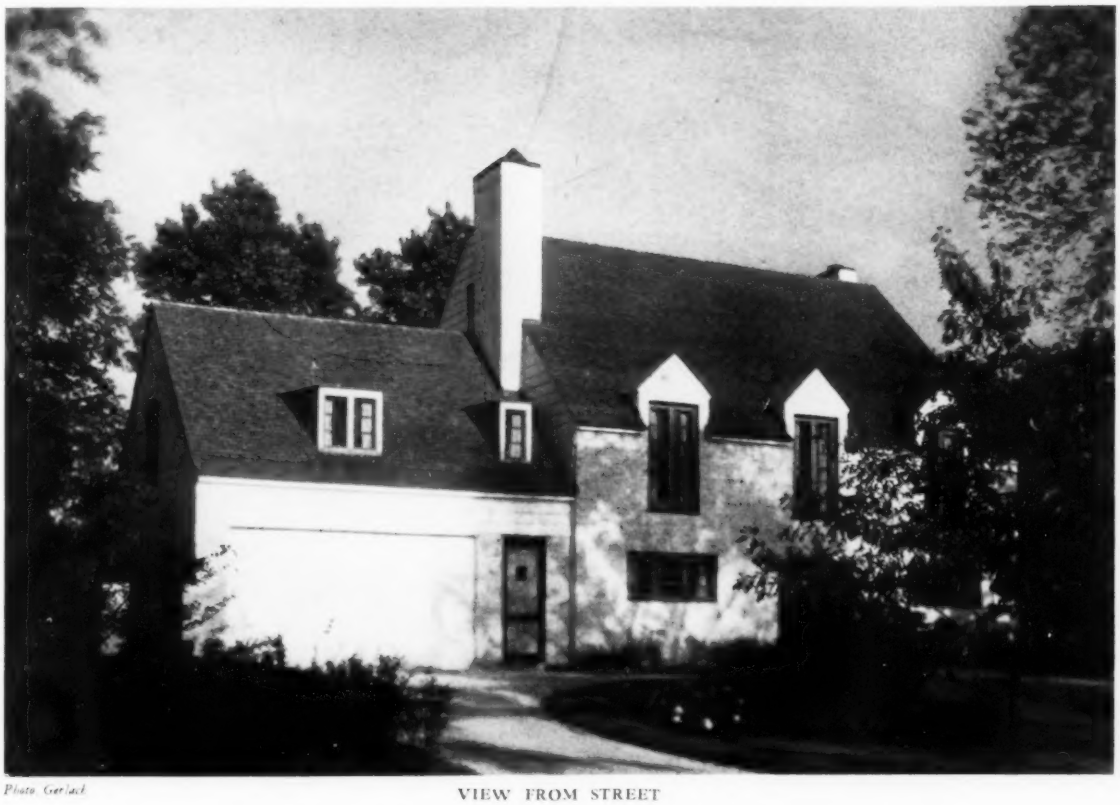


Photo. Gerlach

VIEW FROM STREET

HOUSE OF WILLIAM A. KITTREDGE, EVANSTON, ILL.

A. ERWIN NICOLAI AND RALPH E. STOETZEL, ARCHITECTS

Construction of common brick painted white. Cedar shingle roof stained light brown. Wood casement windows; sash painted Chinese orange red, in black frames. Iron grills painted black. (Lot size 70′ x 150′. House and garage 60′ long.)

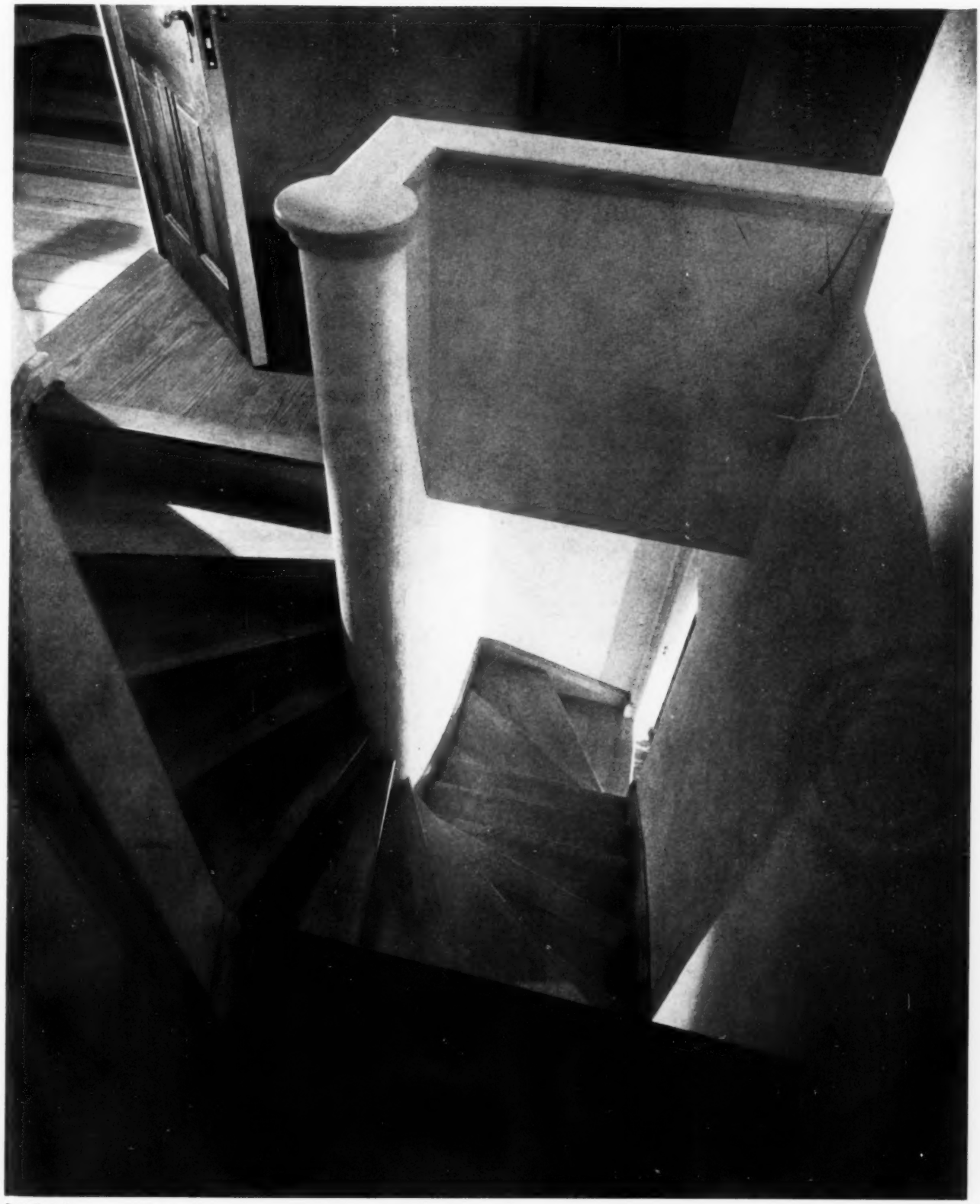
Photo. Garlach

MAIN ENTRANCE ON DRIVEWAY

HOUSE OF WILLIAM A. KITTREDGE, EVANSTON, ILL.

A. ERWIN NICOLAI AND RALPH E. STOETZEL, ARCHITECTS

Walls of common brick painted white. Door and shutters black. Plain lighting fixtures



Photo, Gerlach

STAIRWAY FROM BACK HALL TO STUDIO AND KITCHEN BELOW

HOUSE OF WILLIAM A. KITTREDGE, EVANSTON, ILL.

A. ERWIN NICOLAI AND RALPH E. STOETZEL, ARCHITECTS

Sand plaster walls. Stair treads shellacked. Wood trim, lemon yellow

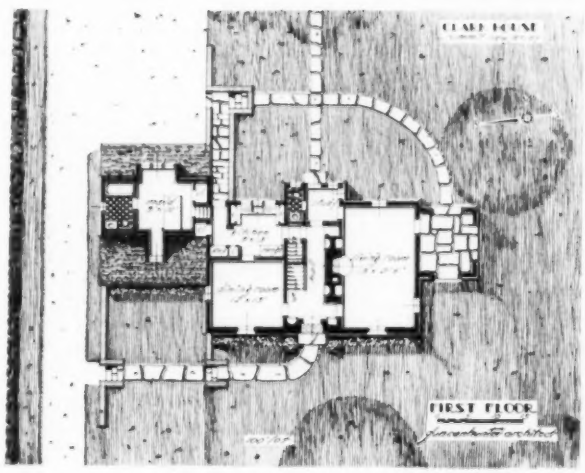
Photo. Gerlach

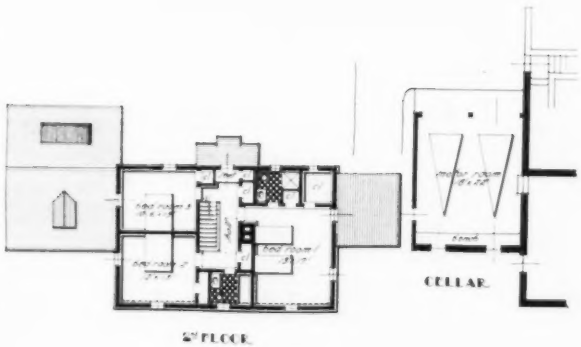
LIBRARY

HOUSE OF WILLIAM A. KITTREDGE, EVANSTON, ILL.

A. ERWIN NICOLAI AND RALPH E. STOETZEL, ARCHITECTS

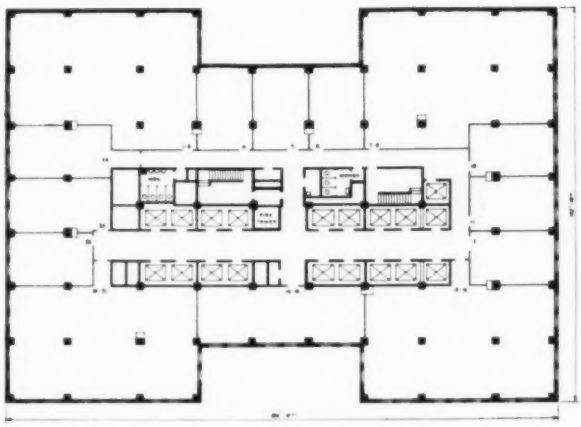
Floor of oak dark stained. Cases, doors and paneling of birch oiled and waxed. Plaster walls, below moulding, deep blue; above moulding and ceiling, plain sand plaster





HOUSE OF HOWARD A. CLARK, SUMMIT, N. J.
DUNCANHUNTER, ARCHITECT

ENTRANCE
HOUSE OF HOWARD A. CLARK, SUMMIT, N. J.
DUNCANHUNTER, ARCHITECT



66TH AND 67TH FLOORS

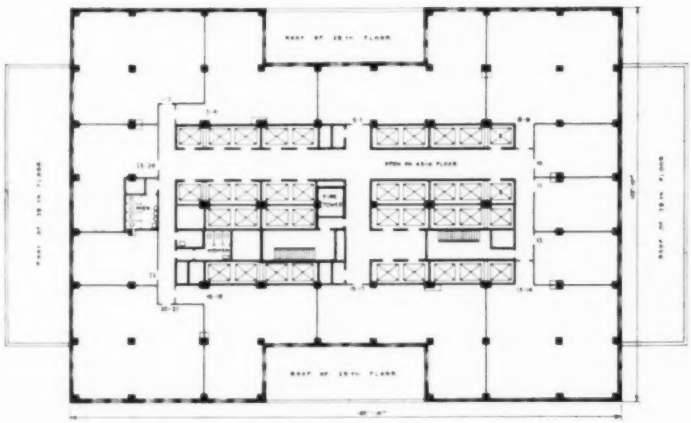
THREE TYPICAL FLOOR PLANS

EMPIRE STATE BUILDING, NEW YORK CITY

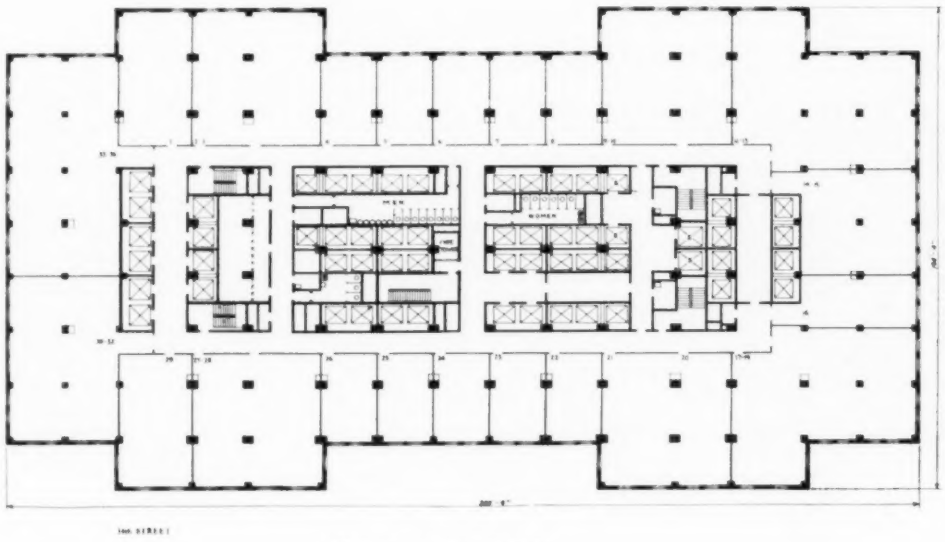
SHREVE, LAMB AND HARMON, ARCHITECTS

(Under construction)

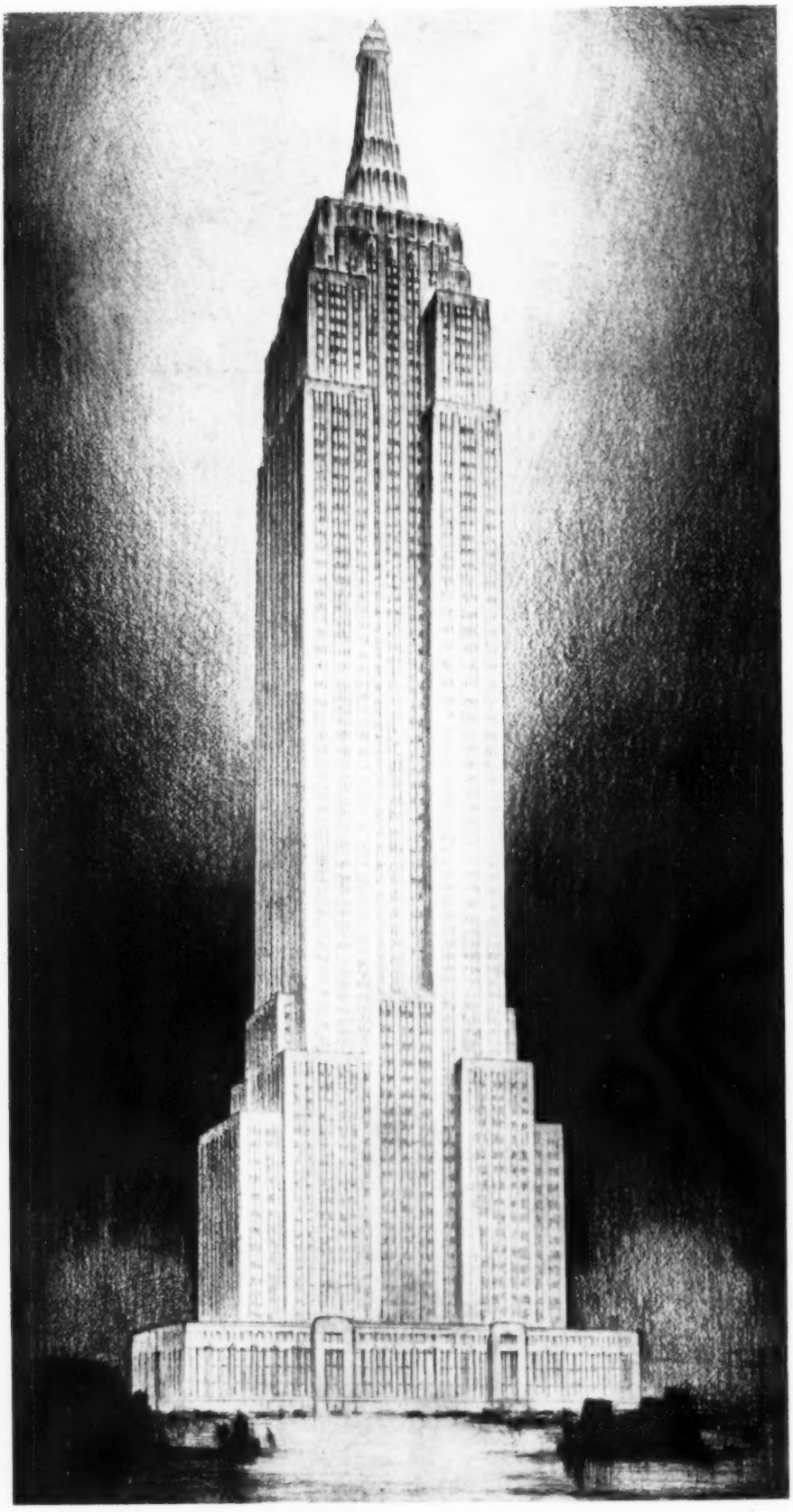
(To go with frontispiece, on next page, of an article on "The Economic Design of Office Buildings," by R. H. Shreve)



30TH AND 32ND; 40TH AND 43RD FLOORS



6TH TO 20TH FLOORS



PRELIMINARY SKETCH
PERSPECTIVE

EMPIRE STATE
BUILDING,
NEW YORK CITY

SHREVE, LAMB AND
HARMON, ARCHITECTS

(See plans on back)

THE ECONOMIC DESIGN OF OFFICE BUILDINGS

BY R. H. SHREVE,

of Shreve, Lamb and Harmon, Architects

THERE are now in existence or in course of construction in New York at least ten buildings fifty stories or more in height and many others approaching this measure.

One of these, the Empire State Building at Fifth Avenue and 34th Street, is to be the largest of its kind in the world. Six months ago the working drawings for this building had not been begun; one year from now it will have been completed, ready for the 20,000 tenants which it is capable of accommodating! A project involving a cost of fifty millions of dollars, containing over two million square feet of usable area in a cube of thirty-five million feet, sustained by a frame composed of fifty thousand tons of steel rising nearly a quarter of a mile above the foundations, is to be designed, erected and completed for occupancy in a brief eighteen months.

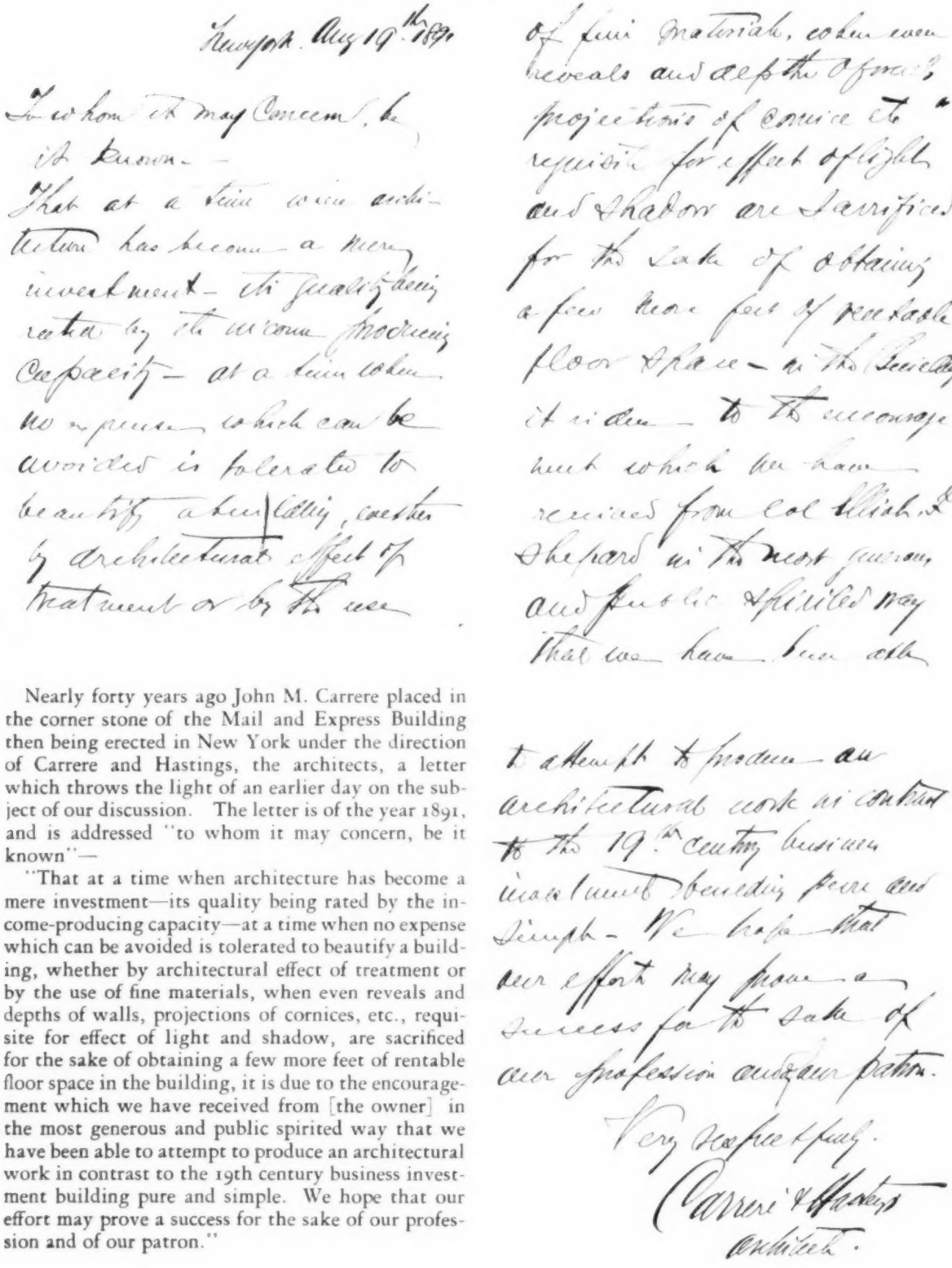
Stone from Maine and Indiana, steel from Pittsburgh and Elmira, cement from Pennsylvania and New York, timber from Oregon or the Carolinas, brick from the Hudson River Valley or from the clay pits of Connecticut, glass from Ohio, marble from Vermont or Georgia or Italy, sand from the shores, stone from the hills, materials from all the world must come together and fit together with accuracy of measurement and precision of time if the procession of construction is not to be thrown into confusion, carrying the dollars away in the ruin. One may well believe that with its organized cooperation in the labor of men and the fabrication and placing of materials, its precision of performance to match the timing of a trunk-line railroad and connecting services, almost the powers of Aladdin's genii harnessed for a building project, none of all the ancient world wonders in any way matched the amazing assembly of skilled craft and fashioned materials which with uncanny accuracy find their places in the daily wrought miracle of a modern skyscraper.

"Why and how is all this made possible?" is the question asked by students of the moving forces of our architectural growth. Even among those most closely identified with the development of the city there are wide differences of opinion as to the place of the skyscraper in any sound scheme of planning. That gracious critic, Mr. Cortissoz, granting that "it is magnificent," asks dubiously "Is it architecture?" Others still are resentful of the intrusion of a cold Martian calculation of values in the field of aesthetic study, and deplore the dominance of these giants of business in one corner of the world of art. Neither these queries nor these protests are new.

LEFCOURT NATIONAL BUILDING,
SHREVE AND LAMB, ARCHITECTS

FACSIMILE COPY

Letter placed in the cornerstone of the Mail and Express Building, New York City, by John M. Carrere in 1891
(For transcript in type, see below)



Nearly forty years ago John M. Carrere placed in the corner stone of the Mail and Express Building then being erected in New York under the direction of Carrere and Hastings, the architects, a letter which throws the light of an earlier day on the subject of our discussion. The letter is of the year 1891, and is addressed "to whom it may concern, be it known"—

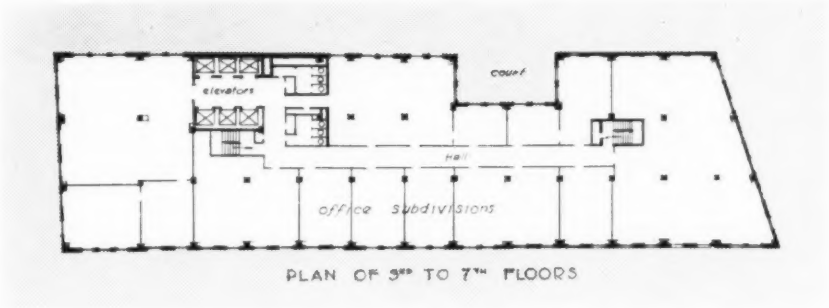
"That at a time when architecture has become a mere investment—its quality being rated by the income-producing capacity—at a time when no expense which can be avoided is tolerated to beautify a building, whether by architectural effect of treatment or by the use of fine materials, when even reveals and depths of walls, projections of cornices, etc., requisite for effect of light and shadow, are sacrificed for the sake of obtaining a few more feet of rentable floor space in the building, it is due to the encouragement which we have received from [the owner] in the most generous and public spirited way that we have been able to attempt to produce an architectural work in contrast to the 19th century business investment building pure and simple. We hope that our effort may prove a success for the sake of our profession and of our patron."

TYPICAL FLOOR PLAN

THE STANDARD BUILDING, ALBANY, N. Y.

SHREVE AND LAMB, ARCHITECTS

This building will be found under (3) in the tabulation of essential plan data for five buildings, on page 358



PLAN OF 3RD TO 7TH FLOORS

Whatever may have been the measure of his success, Mr. Carrere's protest was unavailing. Soon after the letter was written, when the building whose birth it signalized was at the age of 25 years, it was torn down to make way for an addition to one of its commercial neighbors requiring more floor space. And today, less than 40 years after the writing of this letter, New York owns many business structures of unquestioned dignity, of "fine materials" and beauty of treatment, and at least one of them will be without "reveals or depths of walls, projections of cornice" or other of the lamented traditions, but with a charm and logic of design marking a distinct advance in art and structure,—at once not a "contrast" but a combination of "an architectural work" and "a business investment building."

If, as Mr. Cortissoz suggests, it may "be necessary some day to invent a new word to designate the new style, a word drawn from the terminology of engineering, with aid from that of the mechanics rather than the art of building," the dominant expression of that word should be borrowed from the principles of sound design and ordered thought.

For so successful has been the effort of the more modern American architects to interpret the demands of economics and to characterize utility and structural form, that we have today in our modern business buildings an expression in architectural style most encouraging to the fine art of building. These structures are the response to business standards and business demands, and they must meet certain established tests if they are to be considered successful, and are to survive either as individual buildings or as a type.

Today, as in Carrere's day, the modern office building presents a challenge to architecture in the problem of enclosing usable space—attractively, promptly, economically and with sound logical construction. And the office building deserves not alone a high quality of architectural design, but skillful *economic planning*, which means such treatment of the site and the structural elements as will produce an arrangement of space and equipment capable of earning income in excess of expense. It is with such economic planning that these notes are chiefly concerned, not through the presentation of the detail of the design of a single building but through the review of certain fundamental principles underlying the correct study of such buildings as a type.

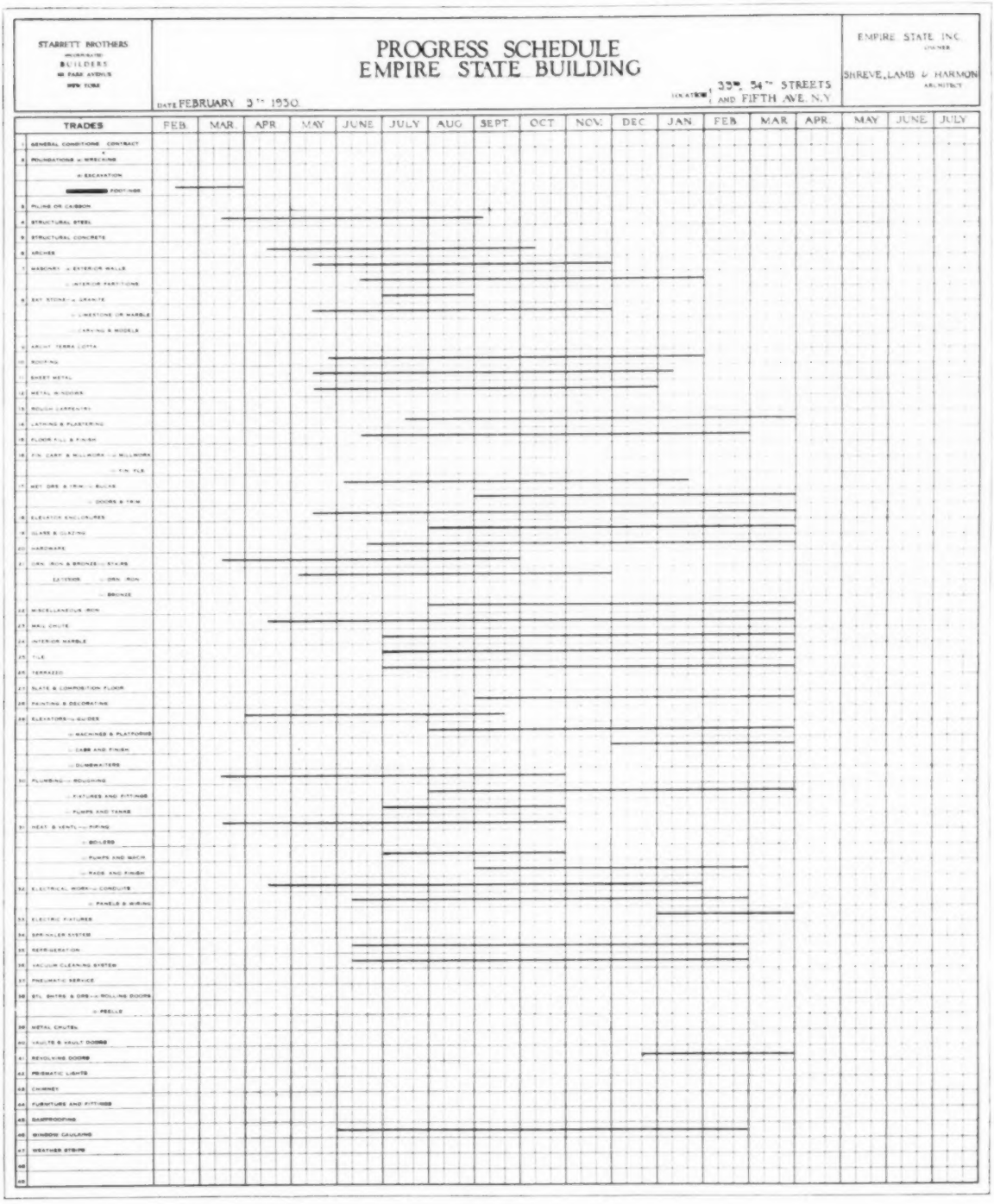
To set up properly an income-producing building the control of its design and construction should be in the hands of a Board on which sit Owner, Banker, Builder, Architect, Engineers, and Real Estate Men. The record of their decisions finds place in plans, specifications and contracts, financial transactions and leases, and the outcome of their work, if it is to be successful, must have been foreseen far in advance of its realization.

The program starts with the selection of a site; many may be considered, but for each there must be made an analysis of cost of land and building, method of financing, total and net investment and total and net income. For the production of income (or its equivalent) is the primary purpose of building, and whether the structure is to be the home of a great business, such as a public service corporation or a life insurance company, or the abode of numerous tenants constituting a mixed occupancy, it is necessary, if it is to be income-producing and not income-consuming, that it should meet the test of the economic and legislative factors which affect every business building project.

One of these factors, and a most important one, is the *time element*, the answer to the questions "When?" and "Within what time?"

In order that invested capital may be kept to the lowest possible figure and income produced at the earliest possible date, the work must be done in the least possible time consistent with comparative economy.

It is because of this principle that New York has witnessed the erection *in one year* of the Bank of Manhattan Building at 40 Wall Street, requiring the demolition of existing stone and steel buildings covering a site over 40,000 feet in area, and the creation of a sixty-odd story structure, now the tallest in the world, all of the work including demolition and foundations being done in the twelve months between May 1, 1929 and May 1, 1930.



PROGRESS SCHEDULE SHOWING PROGRAM OF CONSTRUCTION

EMPIRE STATE BUILDING, NEW YORK CITY

SHREVE, LAMB AND HARMON, ARCHITECTS

A chart of this nature shows how carefully the many processes that go into the building of a modern office structure are timed and controlled. "The plaster may appear in the lower floors before the roof, many stories above, has been made tight."

Item (4) fixes the time within which the steel is to be erected. This item by itself is shown on page 346 carried into greater detail.

PROGRESS PHOTOGRAPH

EMPIRE STATE BUILDING, NEW YORK CITY

SHREVE, LAMB AND HARMON, ARCHITECTS

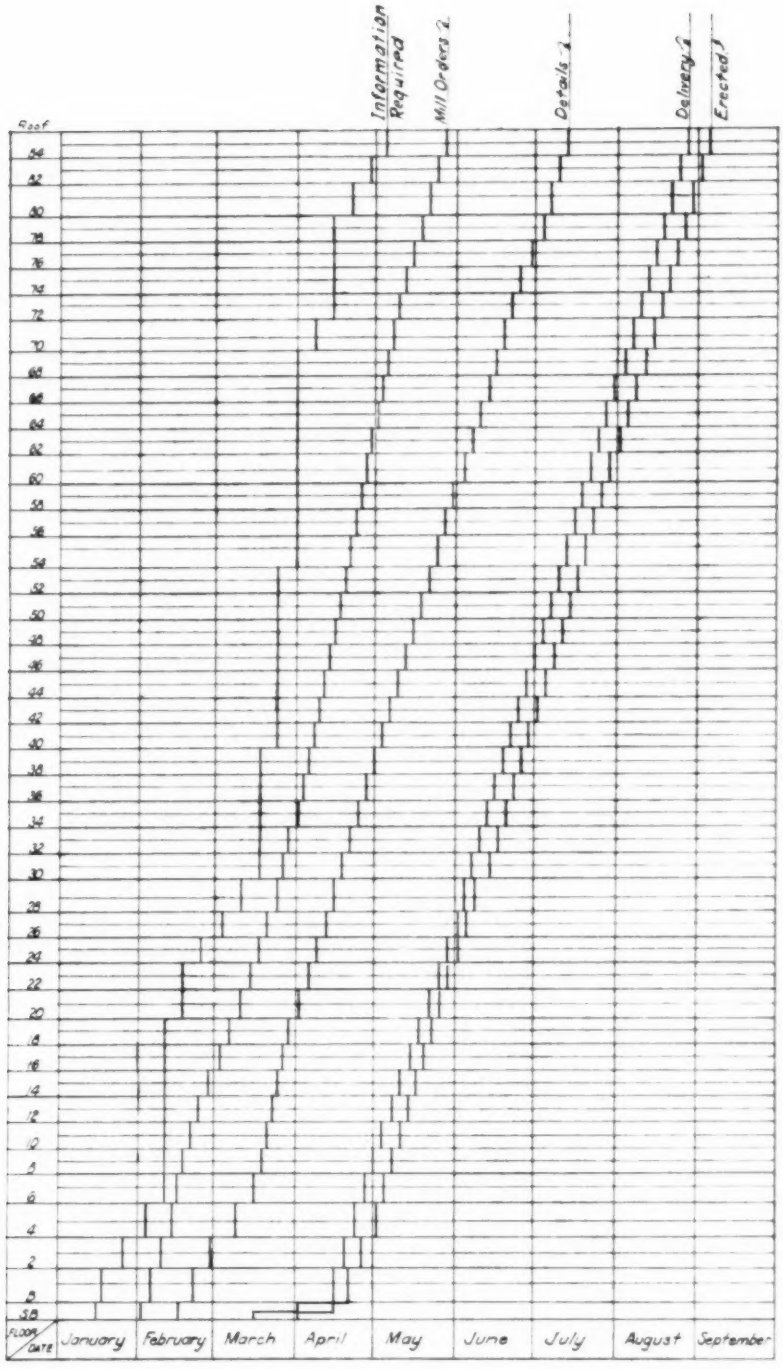
Showing three processes going on side by side: (1) Demolition of the existing structure, at the left; (2) moving out the rock, at the right; and (3) placing footings, in the center.

(See text directly below)

It is for this reason, too, that a greater construction program is being developed in the case of the Empire State Building, requiring feats of organization in some respects never before attempted. Excavation in rock far below the street goes on for twenty-four hours a day; foundations are placed at one side of the property as the steamshovels and drills carry on on the other; steel columns, some weighing a ton to the linear foot, and girders and beams finished to a sixteenth of an inch, are in various stages of progress at mill and shop or stored ready for delivery in the New Jersey yard, with some truck loads crossing the river, others toiling to reach the site through New York's one-way traffic system, while still others stand at the building unloading, and high above the street great bundles of metal at the ends of cobweb cables swing onto the working platform where steel members lie in orderly arrangement to be set in place by the erecting gang. The prompt delivery and precise erection of 50,000 tons of steel in five months is an essential of the completion of the program. Just below the top-most steel, as it is set, are the riveters securing the lower members in place; alongside and through the frame rise the stairs taking the place of ladders, and at many points are visible the main lines of the pipe trades, the veins and arteries attaching to the steel skeleton. Floor arches, exterior walls and windows, elevator hatchways, finished floors, marble halls, and all the finishing trades follow in such a rapidly moving but orderly parade that the plaster may appear in the lower floors before the roof many stories above has been made tight.

The demands of such a program necessitate the employment of every practical means for shortening the elapsed time required for all construction operations in an effort first to reduce that part of the cost which is known as *carrying charges* during construction, including interest on investment, taxes, etc., and second to avoid loss of rent through completion later than May first, which is the date as of which most business-space leases begin, just as dwelling-space leases date from the first of October.

For this reason the time for beginning building operations should be so calculated that the structure, completed in the shortest possible period consistent with relative economy, shall be ready for occupancy before the first of May, for otherwise the loss of in-



DETAILED PROGRAM FOR MANUFACTURE AND ERECTION OF STRUCTURAL STEEL

EMPIRE STATE BUILDING, NEW YORK CITY

SHREVE, LAMB AND HARMON, ARCHITECTS

Fixing dates for (1) furnishing complete information by drawings, (2) placing mill orders, (3) completing fabrication details, (4) delivering, and (5) erecting, for the steel of each tier.

come for the period through which the rentable space is unoccupied must be added to the loss due to fixed charges on capital invested and the outlay necessary to operate and maintain the building.

This time-element enters into our economic study as a variable factor measurably under control; a second influence, *land cost*, is less flexible and, indeed, at present in New York appears as a most compelling influence.

The Waldorf-Astoria Hotel site, upon which the Empire State Building is to be placed, is reported to have cost $16,000,000: something over $8,000,000 an acre. The plot at the corner of Fifth Avenue and 43rd Street was a few years ago sold at a price approximately $340 a square foot, or $15,000,000 an acre. Land at No. 1 Wall Street facing Broadway, now being built upon, is reported to have cost the present owners between $700 and $800 for each square foot, at which rate an acre would reach a price of $35,000,000 or $40,000,000.

There is a difference of opinion as to whether this high land cost is the reason for the intensive building development, or whether permitting the intensive development is what causes the high land cost, but the fact is that with these and even lower land prices, which prevail in most of those sections of New York in which office buildings are built, the structures erected are designed to be of such a nature, extent and arrangement as to justify and support by income-production the high cost of the site. It is therefore a prime requisite that the design shall distribute the cost of the land over the largest practical area of usable floor surface set up in accordance with building cost, building laws and profitable use; all influences which must be given our consideration.

Building cost is both a result of the study of the design of the building and a factor influencing that design through determination of the methods of construction, selection of materials, and arrangement of structural elements which make up the occasion of the total expenditure for the building itself, and which, later, will enter into the analysis of the design from the economic view-point.

But municipal and state laws and the Economic Law have a greater effect than building cost or structural problems in governing the production of floor space, or the height and bulk of business buildings, in the City of New York, so we shall need to see how these two forces, municipal and Economic Law, operate.

Zoning. The Building Zone Resolution of the City of New York divides the entire city into Areas or Zones classified under three heads and dealing with:

1. The *use* of the property and buildings;
2. The *area* of the site built over;
3. The *height* to which the building may be carried.

The *use* we are considering is that of the office building; the *area* permitted to be built over will be considered as unlimited (save as courts are required to permit legal sub-division of larger spaces); we may then give our attention entirely to the law controlling the *height*.

Upon the street lines or building lines of a given property the exterior walls may be carried only to the height fixed by law. This limit is related to the width of the street in front of the site, the permitted height in different districts being from ¼ to 2½ times the street width. Thus in a 2-times district and on a site facing a street 100 feet wide, the wall on the building line may not be carried more than 200 feet above grade, while on a 60-foot street a height of only 120 feet would be allowed. These limits may be extended through excess-height allowances, permitted where neighboring buildings exceed the standard lawful height.

Above this street-wall height-limit the bulk of the building must be kept within sloping lines setting back from the street front one foot horizontally for each unit of height—this set-back height unit factor being twice the factor used in fixing the street wall height; thus, in a "2-times" district the slope is one in four, in a "2½-times" district one in five.

Different rates of set-backs govern the walls on yards or courts; dormers, so-called, are permitted under certain conditions; special rules govern in special circumstances quite too complicated to permit discussion at this time; but finally, the tapering structure having been reduced by a series of set-backs to a building area equal to one-quarter of the site area, the tower condition is arrived at. Above this level the building, that is the tower, may lawfully extend to any height, but the study of the mass to determine this height is governed more by the Economic Law and structural problem than by man-made codes.

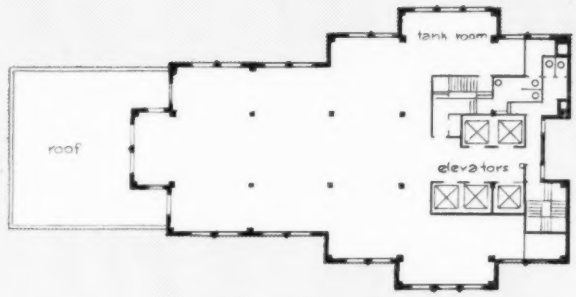
This maximum permitted envelope, a geometrical form consisting of a base enclosed by vertical walls, an intermediate section defined by sloping limits, and a tower, must be analyzed to determine how most profitably to place within it practical usable office floor area, supported and enclosed by structural forms, served by mechanical equipment, and reached through public spaces which are not directly sources of revenue. This problem which includes fixing the height of the tower is solved by study of the floor plans of the building, by the application of the Economic Law to the form evolved under the Zoning Ordinance. The important floors requiring attention are the ground or first floor, the *typical office floor*—that is, one of the large number of floors occupying the base of the building,—the *set-back floors*, and the *tower floor*.

LEFCOURT NATIONAL BUILDING, NEW YORK CITY

SHREVE AND LAMB, ARCHITECTS

(See plans on opposite page)

The most important of these is the *typical floor*, first because from it generally is derived a great part of the rental income, but more especially because its plan governs the plan of the *ground floor* below and the *tower floor* above. There are buildings in which the ground floor plan has been permitted to control the balance of the building. The result is not often fortunate and is frequently disastrous, but in some cases such as use of the ground floor by a bank, may be justified. In order that we shall not complicate our analysis, we may make an assumption quite common in the study of an office building in its preliminary form, that the floors below the third are likely to be of special nature, involving special planning and producing income at special rates; and so we may proceed to the study of the body of the building, beginning with the arrangement of the typical floor.



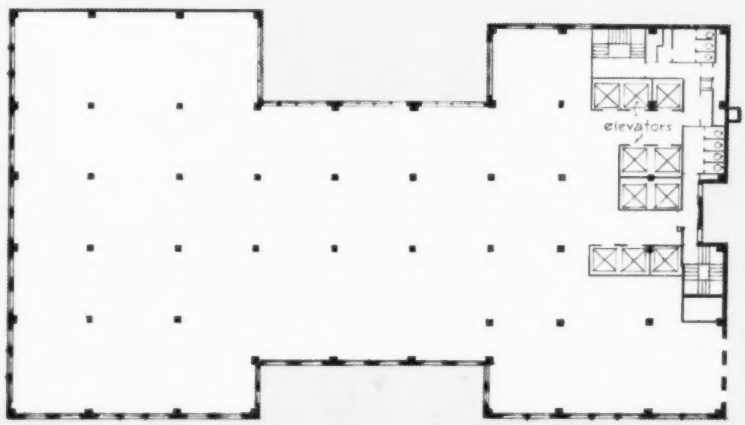
·PLAN · OF · TOWER·

THREE KEY PLANS

LEFCOURT NATIONAL BUILDING, NEW YORK CITY

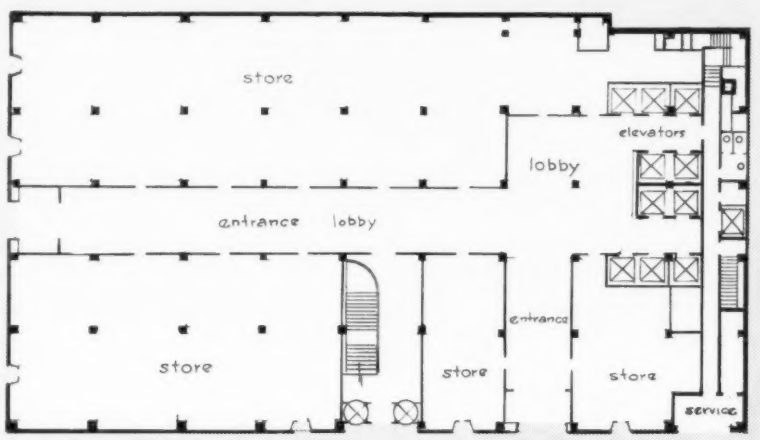
SHREVE AND LAMB, ARCHITECTS

(This building is shown as Number 2 in the comparative table on page 358)



TYPICAL FLOOR PLAN

THIS TYPICAL FLOOR PLAN is of great importance. The study of this floor determines the location of the utility group which is projected down to the first floor (shown below) and up to the tower plan (shown above)



FIRST FLOOR PLAN

THIS IS THE GROUND PLAN In this particular building, the utilities have been so placed that this floor can be either used as one unit (e.g., for a large store) or subdivided. Note also that the elevators running through to the tower (shown at the top) do not interfere with the local elevators

Rendering by Chester B. Price

GENERAL MOTORS BUILDING, NEW YORK CITY

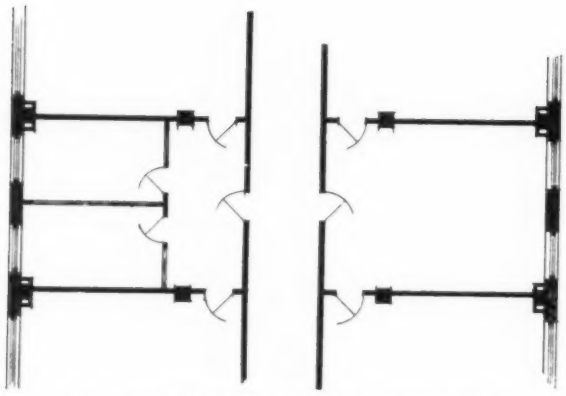
SHREVE AND LAMB, ARCHITECTS

(See plan on page 352)

CHIMES BUILDING, SYRACUSE, N. Y.

SHREVE AND LAMB, ARCHITECTS

(See plan on page 353)



THE CORRIDOR AND OFFICE UNIT

THE PRIMARY ELEMENT OF THE WHOLE STRUCTURE

The designer should keep this basic unit firmly in mind since the office building is essentially a multiplication of such units.

•

Office space as distinguished from loft space is built upon a basic office unit, the cell which multiplied around the central group of building "utilities" may be said to make up the floor plans and so produce the total structure.

In New York this office unit is approximately twenty feet wide, measured between columns along the line of the exterior wall, and is from twenty-five to thirty feet deep from the plaster line. Two windows, each perhaps 4′6″ or 5′0″ wide, provide natural (or legal) light and air. It is possible and practical to form within this larger unit two small offices, each nine to ten feet wide, each having a window and each providing room for one tenant. Two such small offices may have for common use an anteroom or work space opening to the office corridor of the building.

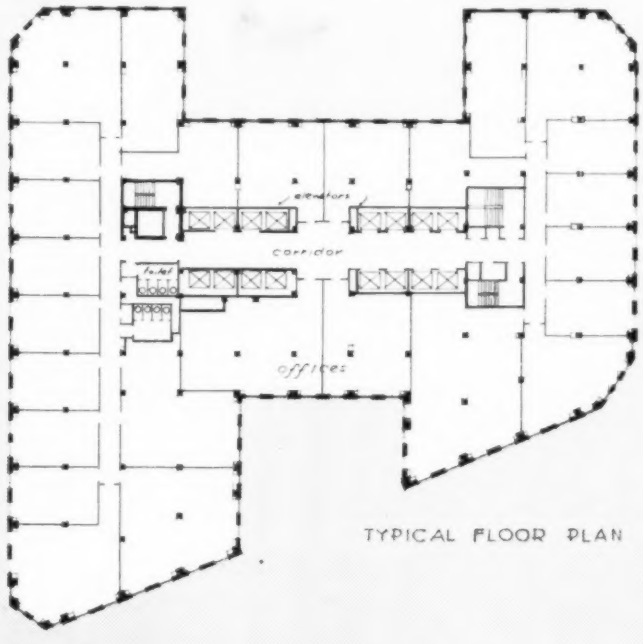
If this office unit is duplicated across the corridor, we shall have established a standard arrangement for a section of an office building containing a corridor six or seven feet wide, with a series of offices on each side about twenty-eight feet deep,—a total width including walls and partitions of say sixty-six feet over all. This type is illustrated by the plan of the Graybar Building.

On the other hand, if such standard office units be placed about an arrangement of elevators, stairs, toilets, and a general group of smaller utilities, such as vents, shafts, slop sinks and meter closets, we shall increase largely the width of the building between outside walls, as in the General Motors Building. But in any case, when we speak of the design of office buildings we must have in mind primarily the arrangement of the *basic unit spaces* with their structural members, their service utilities, and their inter-communication or circulation. In this way we can produce on each floor, and so in the entire building, the greatest practical amount of usable office floor space.

GENERAL MOTORS BUILDING, NEW YORK CITY

SHREVE AND LAMB, ARCHITECTS

Here is the office unit (shown above) arranged about the central utilities in such a way that nowhere does it exceed its normal depth. Those corner offices of which the actual measurements are greater have compensating window exposures. This building is Number (1) *in the Table on page 358*



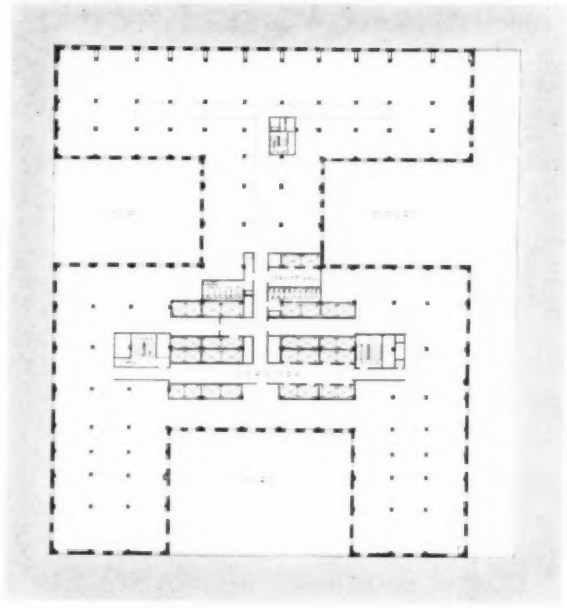
TYPICAL FLOOR PLAN

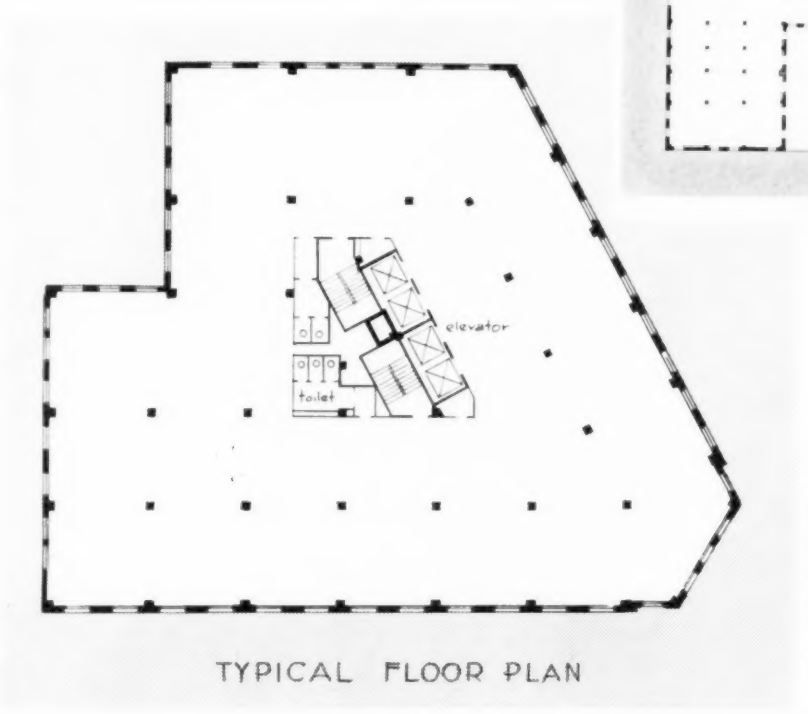
GRAYBAR BUILDING, NEW YORK CITY

SLOAN AND ROBERSTON, ARCHITECTS

The literal multiplication of a unit cell (like that shown on the opposite page) as the office building rambles about seeking space. This is a very efficient and well-lit plan

This plan is referred to in the text on page 352





TYPICAL FLOOR PLAN

CHIMES BUILDING, SYRACUSE, NEW YORK

SHREVE AND LAMB, ARCHITECTS

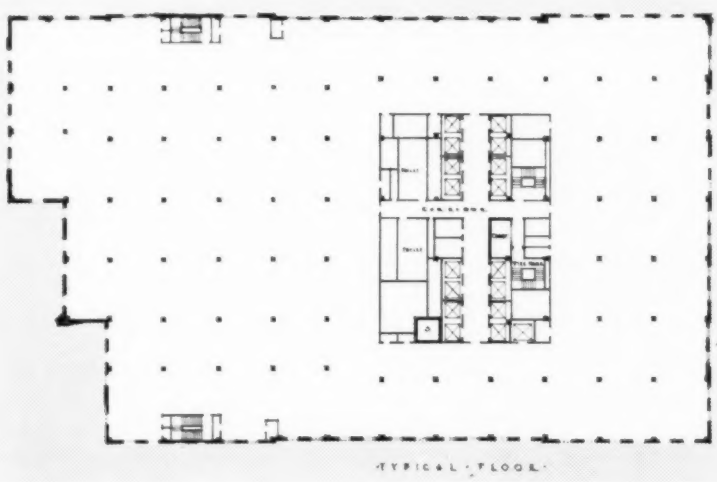
Another example (across the page is the first) of 28′ office units about a central group of utilities. The deeper offices at the angles have compensating light from two sides instead of one. A compact plan

This building is Number (5) *in the Table on page 358*

WESTERN UNION BUILDING, NEW YORK CITY

VORHEES, GMELIN AND WALKER, ARCHITECTS

The exception to prove the rule. This building is arranged with respect to the tenant's special needs instead of following the 28′ office-unit practice



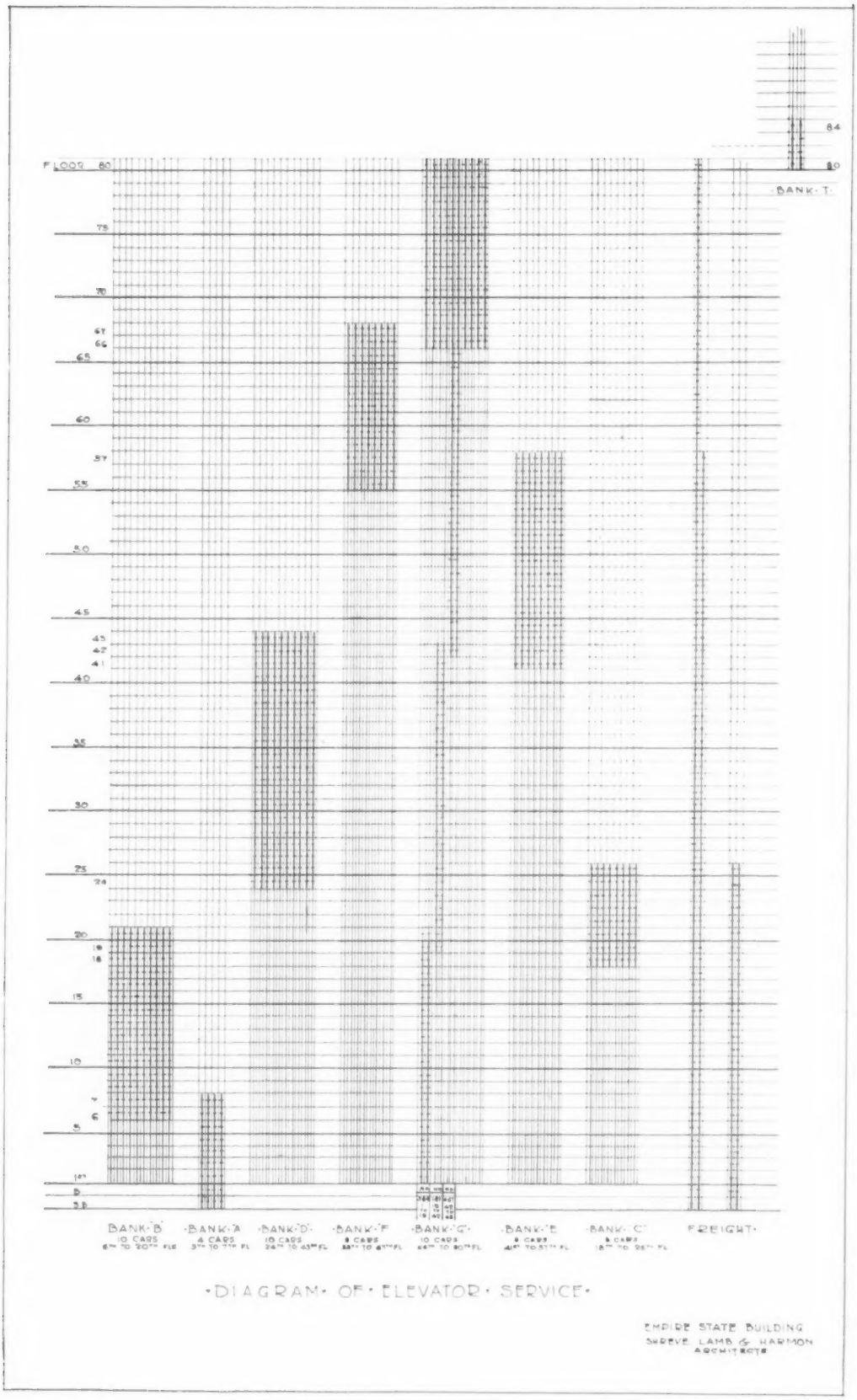


DIAGRAM OF ELEVATOR SERVICE

EMPIRE STATE BUILDING
SHREVE, LAMB & HARMON
ARCHITECTS

To serve this space, to permit its legal and comfortable use, and to make it the source of income, the other essential elements of an office building must be provided.

Elevators take first place in this group. They, more than any other feature of common use by tenants, fix the standard of the building. The determination of the right elevator installation is therefore of the utmost importance. When a building under the so-called "old law" had a uniform floor area and floor arrangement throughout its modest height, it was common practice to approximate the number of cars by providing one car for each 25,000 square feet of floor area. Today, with buildings carried to greater heights or made up of floors of varying arrangement and area and with the sharper demand for better and more rapid elevator service, more accurate calculation of the elevator installation is necessary.

In considering the elevators we must, therefore, first determine the type of building—in the present case an office building;—then the type of tenancy, which may be single-use occupancy as that of the New York Telephone Company's building, or a mixed occupancy as in the standard commercial structure. It is necessary then to establish the probable number of occupants and the proportion of these people who come and leave at one time, as at nine in the morning, or five in the afternoon, or at the lunch hour, these constituting the periods of peak load. It is usual practice to assume as peak load that one eighth or one ninth of the entire building population must be taken care of in five minutes. Further steps in the calculation become more technical but involve the number of floors served as affecting the number of stops, the areas of these floors and their occupancy, and the interval at which cars leave the entrance floor, 20 seconds for excellent service, certainly not over 30 seconds for good service, and not over 40 seconds for fair service. With these conditions known or assumed, we must consider the length of hatchway travel, the speed of the cars, their capacity expressed in number of passengers, the size of cars and number in each bank, the method of controlling the starting and stopping, the control of opening and shutting car gates and hatchway doors; we must allow for a certain number of bad stops or count on mechanical leveling of cars, and must take into account the type of signals; and, allowing for all these and even other factors, we set up our elevator layout. The importance of doing this correctly may be judged from the fact that the existence of an insurance company in a building not designed for such a tenancy has upset the service of an elevator installation otherwise quite adequate to meet normal demands; and the introduction of a stock brokerage house and the use of the elevators by numerous runners incident to its business has destroyed all possibility of satisfactory elevator service.

The position in the building of the elevator hatchways extending vertically through all floors imposes on each other floor from top to bottom of the building a condition practically fixing circulation and plan arrangement. The elevator problem is therefore of importance in any high building, but becomes a vital matter where there are installations of 30, 40, and even 50 elevators, of which there are not a few in New York.

In the design of the Empire State Building every effort was made to concentrate elevator equipment and eliminate unnecessary hatchways; careful study was given to the possibility of operating two cars in one shaft, thus combining the low and high rise banks, and saving floor space and extra construction cost; plans were made also for a transfer floor near the fiftieth story to which high speed express elevators automatically controlled would run from the ground floor. At some near future date such projects will be carried out but for this building no scheme of elevator installation now available was considered more likely to be satisfactory to tenants and landlord than that shown on the diagram presented with these notes.

To meet the requirements of the Building Code of the City of New York adequate *exit facilities* for all buildings must be provided. While there are several types of exits, the most common in office buildings is the fireproof enclosed stairway. For each floor there must be one, and an additional one when the floor area is in excess of 2,500 square feet. For still larger floor areas there must be added stair capacity proportional to the floor's population. This occupancy is to be taken as one person to every 50 square feet of floor surface in office buildings, or such other number of persons as may have been stated in the application for permit to construct the building and approved by the Superintendent of the Bureau of Buildings.

In office buildings exceeding certain stated heights, at least one stairway shall be a fire-tower; that is, the stair shall be enclosed in brick or reinforced concrete and be reached only by an entrance opening to a street front, or the wall of the yard or court, which must be not less than 100 square feet in area.

The capacity of a stairway is required to be calculated on the basis of one person for each full 22" of width and 1½ treads of the stairway, and one person for each 3½ square feet of floor area on the landings and halls within the stairway.

It is the intention of these provisions that the stairways leading down from a floor shall have capacity, measured on the basis just stated, to accommodate the total number of persons permitted to occupy the area which the stairs serve—without the necessity of these persons intruding on stairways below or above.

No point on a floor shall be over 100 feet from a stair, nor, if the floor be divided into offices, shall

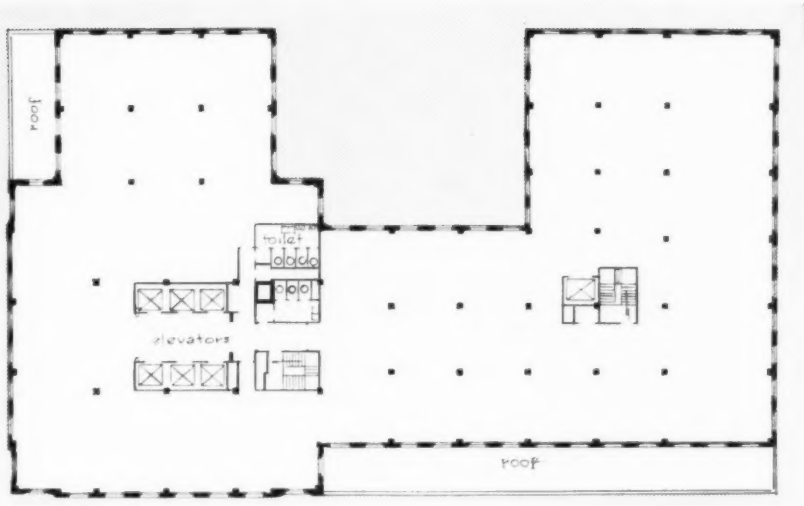
THE REYNOLDS TOBACCO COMPANY BUILDING, WINSTON-SALEM, N. C.
SHREVE AND LAMB, ARCHITECTS

REYNOLDS TOBACCO COMPANY BUILDING, WINSTON-SALEM, N. C.

SHREVE AND LAMB, ARCHITECTS

Again the 28′ deep office is the basic unit, with the utilities occupying the 'blind space.' The set-backs are on the street, and because of the climate there is a wider court than is usual among more northerly cities.

This is Number (4) *in the Table on page 358*



PLAN OF TYPICAL FLOOR
3RD TO 6TH FL. INC.

the door of an office be more than 125 feet distant, along an unobstructed hallway, from a stairway.

All of these stairs must have proper exit connections to street or other approved spaces, and at least one stair must be carried to the roof.

It is in accordance with requirements as detailed as these, and covering also the handrails, treads and risers, landings and openings, that the stairs are fitted into the structure under the provisions of the present Building Code of the City of New York. In the course of the work on the proposed revision of this Code much study has been given to the adequacy of such provisions, especially in relation to very tall buildings. In case of fire or other emergency occasion for use of exit facilities, would the stairs be practically useful? How few persons, even those in normal health and unaffected by emergency exit conditions, could make their way down a thousand steps or more in safety, and how much more difficult would the problem be were there many among them overcome by intolerable conditions or aroused by unusual stress? What assurance can we have as to the movement of smoke under the influence of the chimney effect of a high structure?

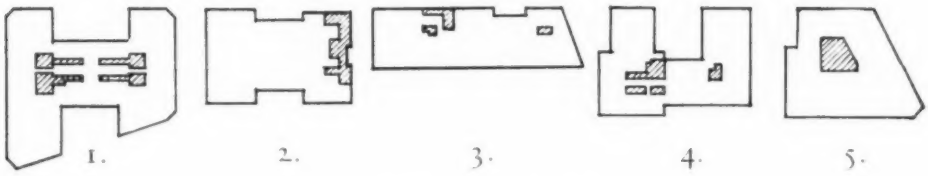
It is possible that refuge areas, especially protected from fire and cut off from the rest of the building may, with the aid of the modern elevator and its closed hatchway, prove to be the safer and more effective first means of exit. Should this or some other variation of the present plan develop, our use and arrangement of floor space would be subject to such revisions.

Where floors are not occupied by a single tenant but are subdivided, passages affording circulation must give tenants access to each stairway, to the elevators and to the toilet rooms; the building service staff must be able to reach the slop sink closet or porter's work room, and the metering closet for electric service control. These passages or corridors, where essential to public or service circulation, should not be considered a part of income-producing space. It is true that where a floor is leased to one tenant, corridors may not always be partitioned off, and the space may be directly useful and under semi-private control; but in principle the ultimate income should not thereby be modified, nor the study of the economic set-up changed.

On each floor provision must be made for the passage of vent ducts or the smoke stack, if there is to be one, for the shafts in which plumbing and other pipes or conduits are carried up through the building, for basin lines at columns and for sprinklers if these are to be used (though this is not customary in office buildings), for electric feeders and telephone and messenger call connections, sometimes for watchman's connections or for fire alarm service lines and stations, and for a mail chute so placed as to meet the requirements of the Federal Government.

(*Continued on next page*)

COMPARATIVE DATA



1. 2. 3. 4. 5.

	1. GENERAL MOTORS BUILDING	2. LEFCOURT NATIONAL BUILDING	3. STANDARD BUILDING	4. REYNOLDS BUILDING	5. ONONDAGA BUILDING
FLOOR TO FLOOR HEIGHT	11′-3″	11′-3″	11′-3″	12′-6″	11′-3″
LOT AREA	32,370	19,047	15,494	26,633	13,681
TYPICAL FLOOR BUILDING AREA	27,100	16,740	14,950	18,723	12,601
TYPICAL FLOOR BUILDING AREA INSIDE WALLS	26,035	16,095	14,341	18,000	12,160
USABLE AREA PER TYPICAL FLOOR	23,695	14,851	12,987	16,225	11,040
Percentage of TYPICAL FLOOR BUILDING AREA TO LOT AREA	84%	88%	97.5%	70%	92%
Percentage of USABLE AREA TO LOT AREA	73%	78%	83½%	61%	81%
Percentage of USABLE AREA to BUILDING AREA INSIDE WALLS	91%	92%	90.75%	90%	90.5%
CUBE OF BUILDING	7,444,971	5,668,957	2,567,856	3,939,841	2,150,000
CUBIC FEET REQUIRED to Produce One Square Foot of USABLE AREA	14¼	15½	15	17½	14½

The several typical office-building floor plans reproduced on these pages serve to show arrangements of open or divided office spaces extending from the perimeter or outer wall into the corridor leading to or built around the elevators, stairs, toilets and other utilities.

Examples varying in plan system have been selected. The General Motors Building, New York, (1), facing four streets, has an internal utility group placed midway between the outer walls and filling the dark corners of the plan. The second office building (2) is a corner property fronting two streets, with all the mechanical and service elements bunched in the inner angle of the plot. One of the most efficient plans is that of the Standard Building, Albany, (3), lighted from three streets, with the utilities grouped on the inner property line, on which also a small court is placed to light the part of the floor space lying near the second stairway. Two of the three facades of the Reynolds Tobacco Company's Building (4) have been set back from the street line to secure better light and air conditions, and a large court has been placed on the inner property line. Utility units are in the darker inner corners of the plan. The fifth plan (5), that of the Chimes Building, Syracuse, shows an inner core of compactly placed service and mechanical elements, securing a maximum amount of floor space well lighted by the two streets and the court in the inner property corner.

All story-heights of these illustrative plans are alike (11′3″ floor to floor) except that the Reynolds building has a greater height (12′6″) affording better light and air conditions, but somewhat increasing the cubical content without increasing the floor area.

The analysis of the several typical floors is noted in the table comparing site areas, building areas, usable space and cubical contents; and the ratios existing between these comparable data.

In the study of the building and the selection of

the best of several floor arrangements, the plan arrived at for the typical floor fixes the fundamental conditions of the *ground floor* and the *tower floor* plans. The next major question is to determine the number of tower floors, the answer to the question,

"How high shall the building be carried?"

Up to a certain height added floors give the advantage of the distribution of the land cost over the added floor space. But as height increases this gain is offset more and more by the need of heavier steel columns and foundations, additional elevators, increasingly disproportionate demands for space for utilities, extreme windbracing, and all-round increased construction cost at the higher levels. Extra stories must be thought of as being added at the bottom of the steel frame instead of at the top, just as if the lower building were lifted and the extra stories put under it, or, otherwise, the load of the added upper space must be provided for by strengthening the steel carried down through the building. Extra elevators are required to serve the added stories, but these cars must run up through the height of the building before they reach the zone which they are intended to serve, and in each story through which an idle hatchway passes 60 to 80 square feet of floor area are given up to the passing car.

In the higher buildings, at present elevator speeds, a car may be ¾ of a minute or a minute or more in travel before making a stop. This may mean 3 or 4 minutes to a car round trip; and in order to maintain the elevator service interval at the ground floor after the first car leaves and before it returns, many more cars must be added to serve these upper floors than would be required to serve an equivalent space at a lower level.

Today in New York ten buildings have a height of 50 stories or more. Higher buildings are being considered. Water supply, house and fire pumps, steam supply, ventilation, all must be especially arranged for service through such a height. Heavy wind pressures on such buildings would produce an actual sway of flexible towers not sufficiently windbraced, and full windbracing adds to steel cost.

Taking into account all of these and other conditions, it is evident that in the case of such buildings there is a point where the balance begins to swing back and the rate of return on capital investment begins to diminish as the building goes higher, unless the owner gets a markedly greater unit return for the higher space, or charges the decrease in the direct net return to "advertising".

Our preliminary study of the economic features of the project closes with fixing the number of stories to be created and the plans of the several floors. A statement may then be set up in the following manner:

OFFICE BUILDING

FINANCIAL SET-UP

Cubical Contents (approx.)	10,188,000 cu. ft.	
Net Rentable Area	738,890 sq. ft.	
Cost:		
Land	$7,000,000	
Estimate cost of bldg. @ 60c cu. ft.	6,112,800	
Architects, Engineers, Builder's fees, Brokerage, Financial, Carrying charges during construction	940,000	$14,052,800
Gross (estimated) mortgages		11,200,000
ESTIMATED EQUITY OR CASH INVESTMENT:		$ 2,852,800
ESTIMATED INCOME:—ANNUAL		
Ground and Second floors, Basement and Sub-bas't Approx. 160,000 sq. ft.	$ 780,000	
Third floor and up	1,740,000	$ 2,520,000
ESTIMATED EXPENSE:—ANNUAL		
Interest on Mortgages	$ 620,000	
Operation (estimated)	420,000	
Average leasing commission	20,000	
Insurance	15,000	
Taxes	275,000	$ 1,350,000
		$ 1,170,000
Deduct amortization of mortgages beginning 2 years after date of mortgage		360,000
		$ 810,000
Allow for vacancies		250,000
ESTIMATED NET RETURN AFTER AMORTIZATION AND VACANCIES:		$ 560,000

Equal to 19.5%
on
CAPITAL INVESTMENT OF $2,852,800.

From such an analysis we may determine if the business outlook is good, and, with the economic problem solved, approach the refinement of the architectural design which has been kept in mind through the survey of the determining factors. The demands of time, cost and practicability need not be hostile to the aesthetic side of the work. Indeed, may it not be fairly said that character is improved and greater success of pure design assured if sound reasoning as to value, and honest recognition of function, accompany and guide our struggle to attain architectural beauty?

Photo. Steiner

NURSERY BUILDING

THE OAK LANE COUNTRY DAY SCHOOL, PHILADELPHIA*

HOWE AND LESCAZE, ARCHITECTS

The school is for children from two to four years of age. The entire scale of the building is, therefore, reduced wherever possible to fit the size of the children. The doors to the classroom are very low and the treads and risers of the various stairs are in proportion. This is in order that the children may feel an intimacy with their surroundings instead of the usual adjustment to an adult world constructed for those of adult size.

•

PLAN

The building in its completed form will consist of two class-rooms connected by a hall, from which open the wash-room and kitchenette, as well as the teachers' private office. Only one of these classrooms has been built, but the adjacent wall of the second classroom is completed so as to close in the end of the porch which is built against the south side of the school building. The porch consists of two levels: the lower constituting an outdoor playground for bad weather, and the upper forming a deck roof reached by a stair from the lower level and used as sun room and playground for clear warm days in spring, when the grounds are still not in a suitable condition for use. This sun room is protected on two sides by the building itself, and is enclosed on the other two sides by a high, solid parapet so that there may be no chance of any child falling over or through a railing. The shelter over the staircase forms a protected corner in the angle facing southeast.

* This building was the gift of Mr. and Mrs. Leopold Stokowski.

Photo. Steiner

DETAIL OF CORNER WINDOW, NURSERY BUILDING

OAK LANE COUNTRY DAY SCHOOL, PHILADELPHIA

HOWE AND LESCAZE, ARCHITECTS

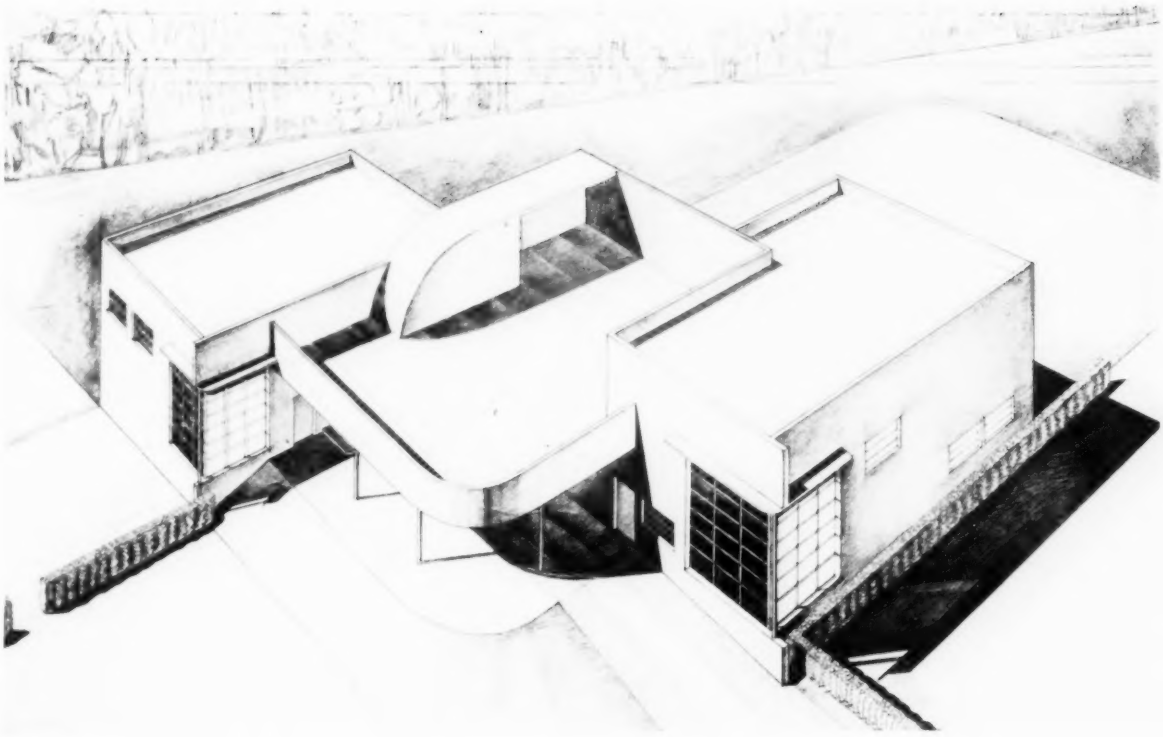
The walls are constructed of concrete blocks covered with stucco. This stucco is white on the walls facing southwest and north, and is painted blue on the walls facing east.

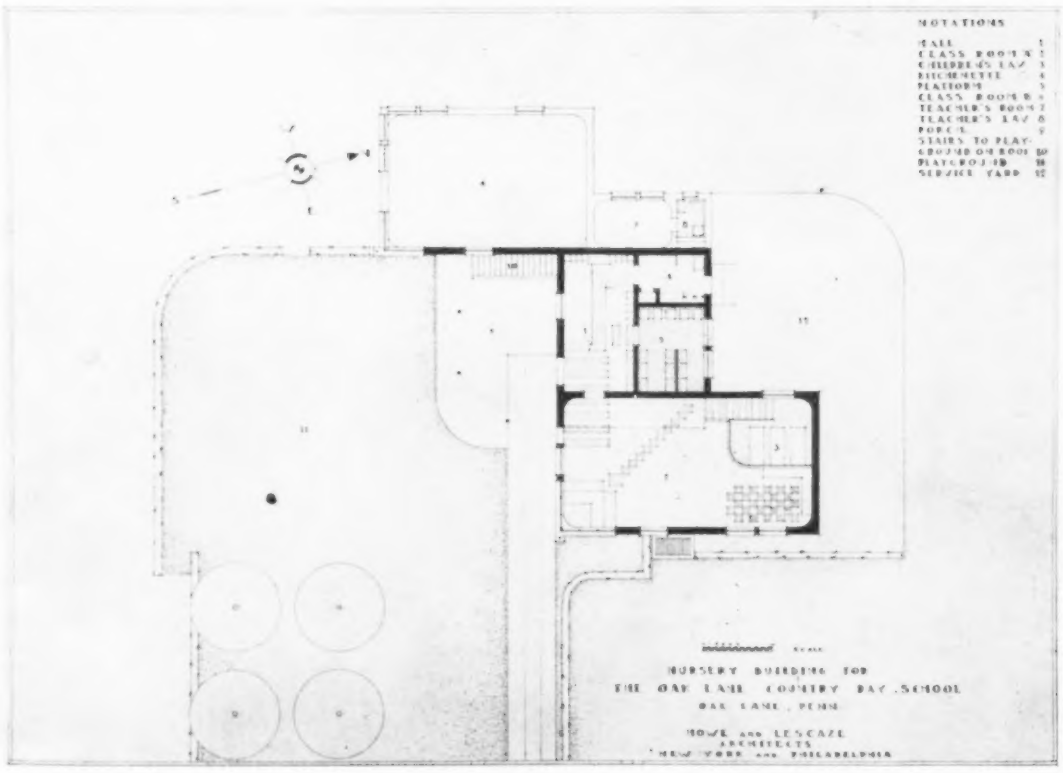
Photo. Steiner

INTERIOR OF MAIN CLASSROOM, NURSERY BUILDING

OAK LANE COUNTRY DAY SCHOOL, PHILADELPHIA

HOWE AND LESCAZE, ARCHITECTS



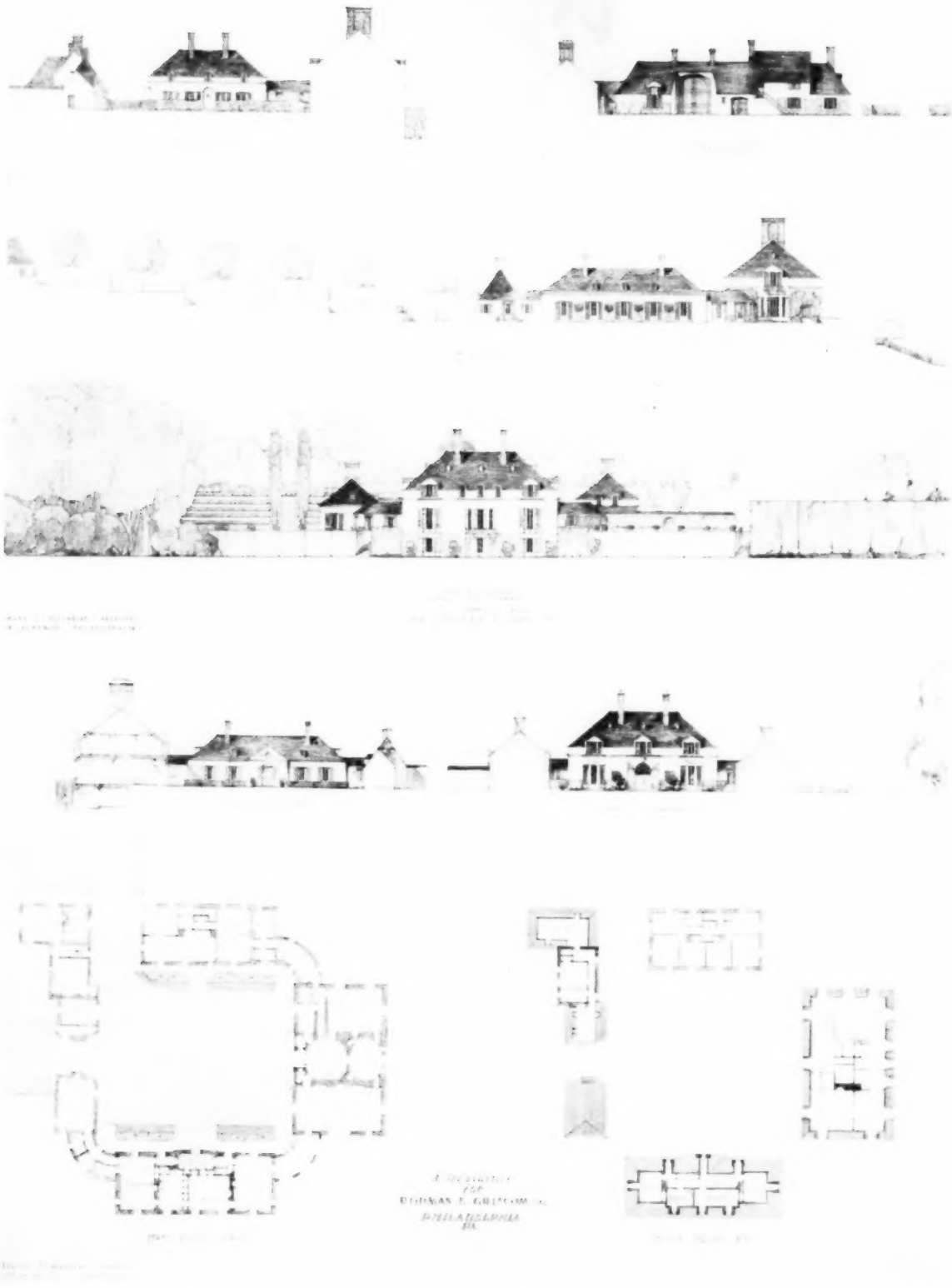


PERSPECTIVE AND PLAN, NURSERY BUILDING

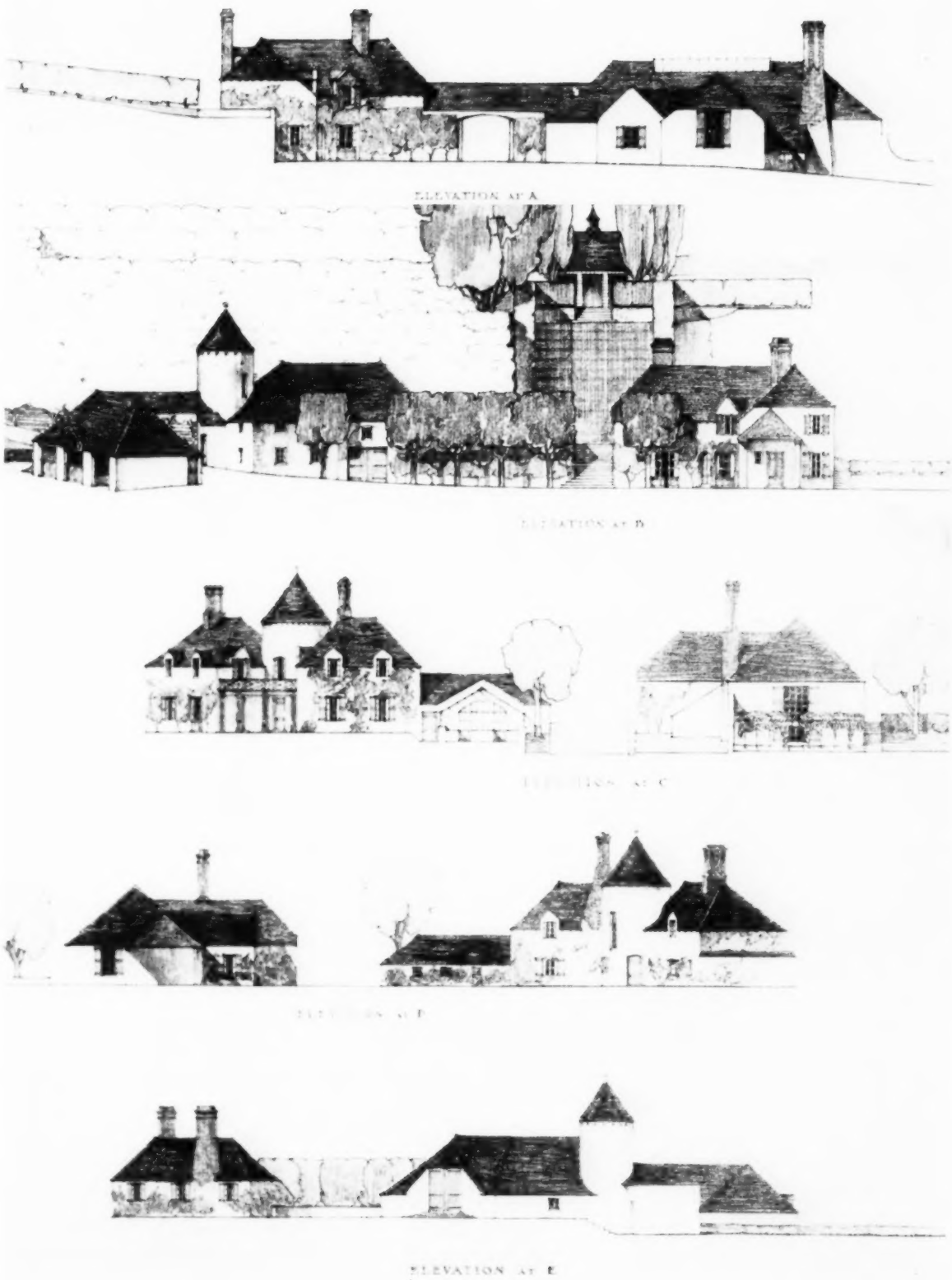
OAK LANE COUNTRY DAY SCHOOL, PHILADELPHIA

HOWE AND LESCAZE, ARCHITECTS

In the interior the hall and classroom are floored with cork in special patterns, as shown above. In the corner of the classroom is a raised platform provided with a staircase of miniature scale which serves either as a secluded corner somewhat separated from the general space of the room, or as an elevated point of vantage in various games.



HOUSE OF MR. RODMAN E. GRISCOM, PHILADELPHIA
EDMUND B. GILCHRIST, ARCHITECT



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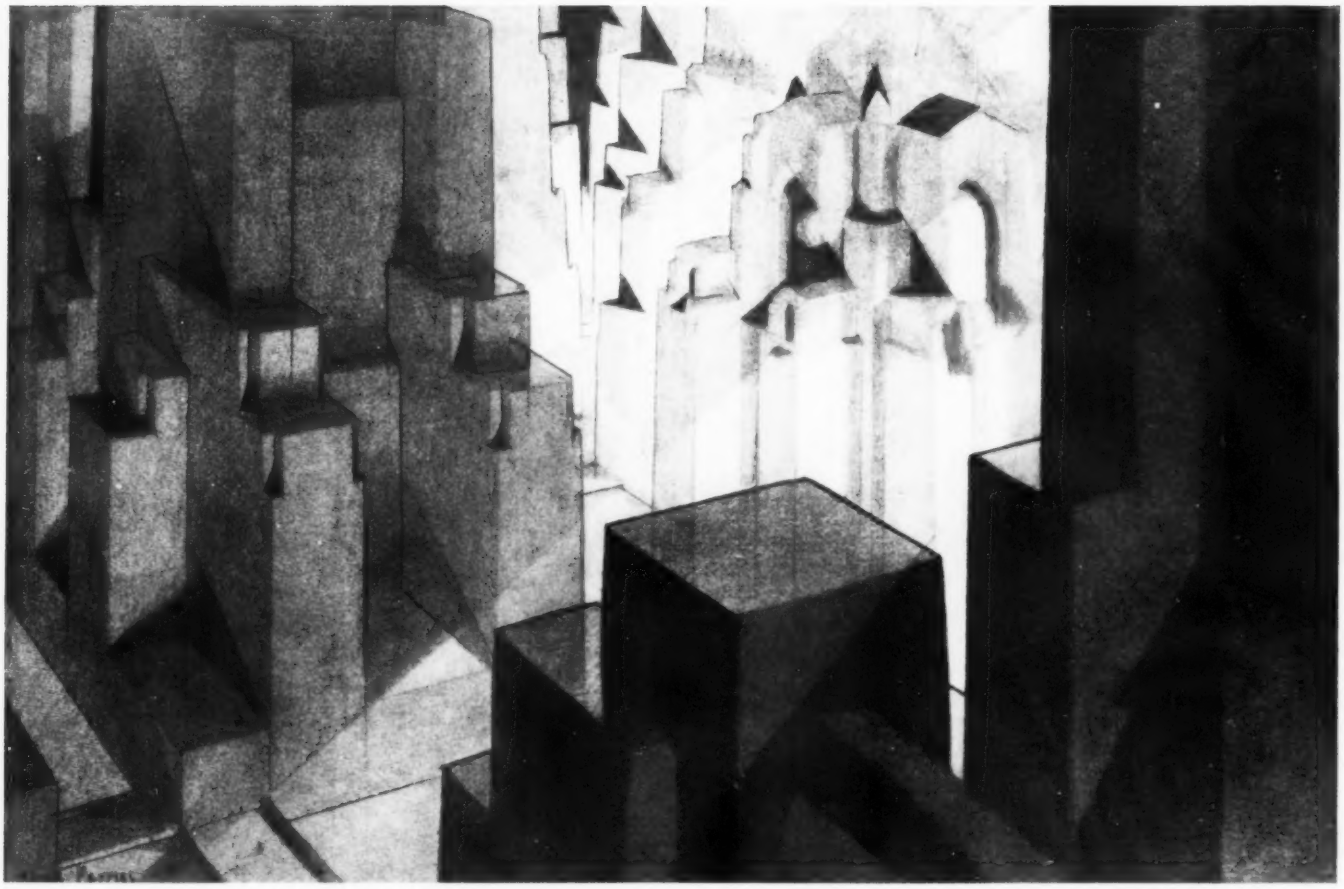
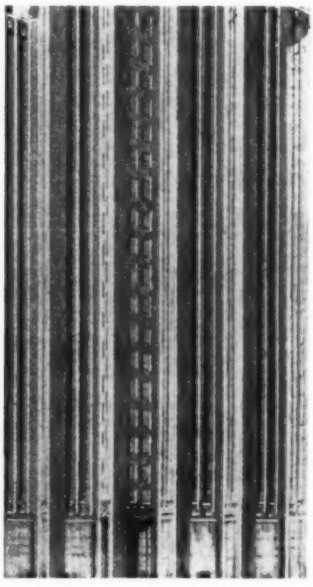


ARE THESE BUILDINGS or gigantic pieces of sculpture? Mr. Ferriss in his idealizations of the American city (The Metropolis of Tomorrow) has well symbolized the present pre-occupation of most of American city architecture with the study of the "mass."



NOT A MODEL but part of a rendering by Mr. Gilbert Hall. "The windows are played down to make the monument look solid."

BUILDING OR SCULPTURE?

The Architecture of "Mass"

"Mass" is the word of the street for the prevailing style of American architecture, particularly as applied to the office building; and it is a good word. The rhythms of our tall buildings are free, now, of McKim and his orders quite as much as of Louis Sullivan and his "steel frame." What do they serve? The designer's conception of the stroke and heft of the building—in short, its mass.

That this is not an architecture primarily of structural fact is no invalidation. Every art has the right to be understood in its own terms. Why do architects so often feel constrained to talk about "structure and construction methods as the basis from which design is developed," when these are almost ignored in their plans and renderings—which could be executed almost interchangeably in brick, limestone, marble, concrete, or even aluminum—and when the thing these architects are really after is plainly something else? Particularly in the steel frame building, structure is now so standardized as to offer, for the moment, no major problems; the face is of no structural interest, being pure veneer; the *basic* factor, however, as any architect will recognize, is rentable cubage.

The office building in terms of mass can be called the effort to convert this cubage into a noble monu-

ment to business; and the private house in the same terms is a jewel-box to house the business man's family and his beautiful possessions. If, in the renderings, all the windows are played down, that is a pardonable excess of the desire to make the monument appear solid and permanent. If, to make set-backs, all sorts of hidden liberties have to be taken with the strict economy of the steel frame, that is not only tolerated, for the sake of light in the street, but willingly grasped, for the sake of variety and interest. And the "simplicity" of profile and ornament so much the vogue is not at all the expression of a "truth"—for on many of our buildings of other types, such simplicity just does not exist—but an expression of desire. It symbolizes that business, too, is noble and human: it too has its aristocracy. Movies and the cheap theatre may still burst with plaster-of-paris and gilt for the populace; but the headquarters of large national firms will outdo one another in the effort to proclaim dignity, conservatism, and a suave elegance.

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Since construction is standardized, and the determining factor in our architecture of "mass" is neither the frame nor the material with which it is faced, but the cubage inside for which it was built, the shell itself has come to have little importance save as decoration. Piers and windows are just line and pattern to help out the mass. What is the difference whether the treatment be vertical or horizontal or both? It is quite at the discretion of the designer. Under the circumstances no great importance attaches even to such innovations as the continuous string windows, so much the vogue in Europe upon smaller buildings. At best these would light only a few more feet in the outer ring. Critics should not be too indignant if such features are just faked, an "effect" without a cause. Even the genuine would be without much cause here. Indeed, the city architect of today is positively compelled to take every license with his lines and openings, in order to deal at all with the difficult problem of camouflaging his haphazard, business-imposed shapes.

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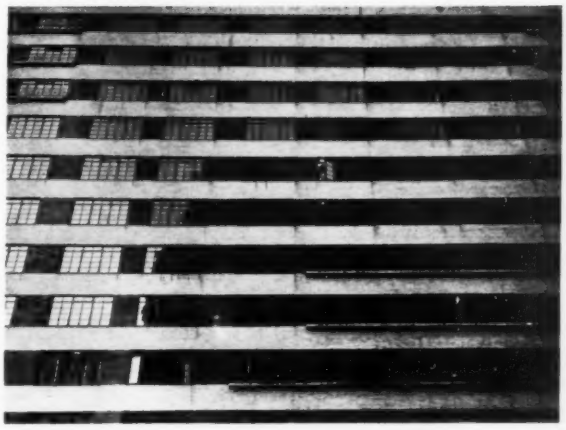
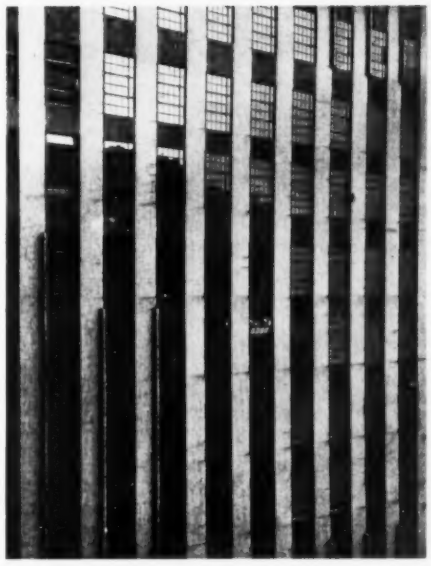
But the mere fact that in our architecture of mass the openings have become little more than a note on the surface is in itself portentous. This is a condition that has seldom existed above ground before. Even in the dim religious light of the cathedrals there was a better relation to the fenestration. The large office building is a radical departure from the great architectural tradition. By comparison with an early example of its own kind, the Tacoma Building, for example—a brave affair which was all window, light, and air—the present skyscraper is heavy and dark; monumental but not architectural. With all its smooth excellence of design,





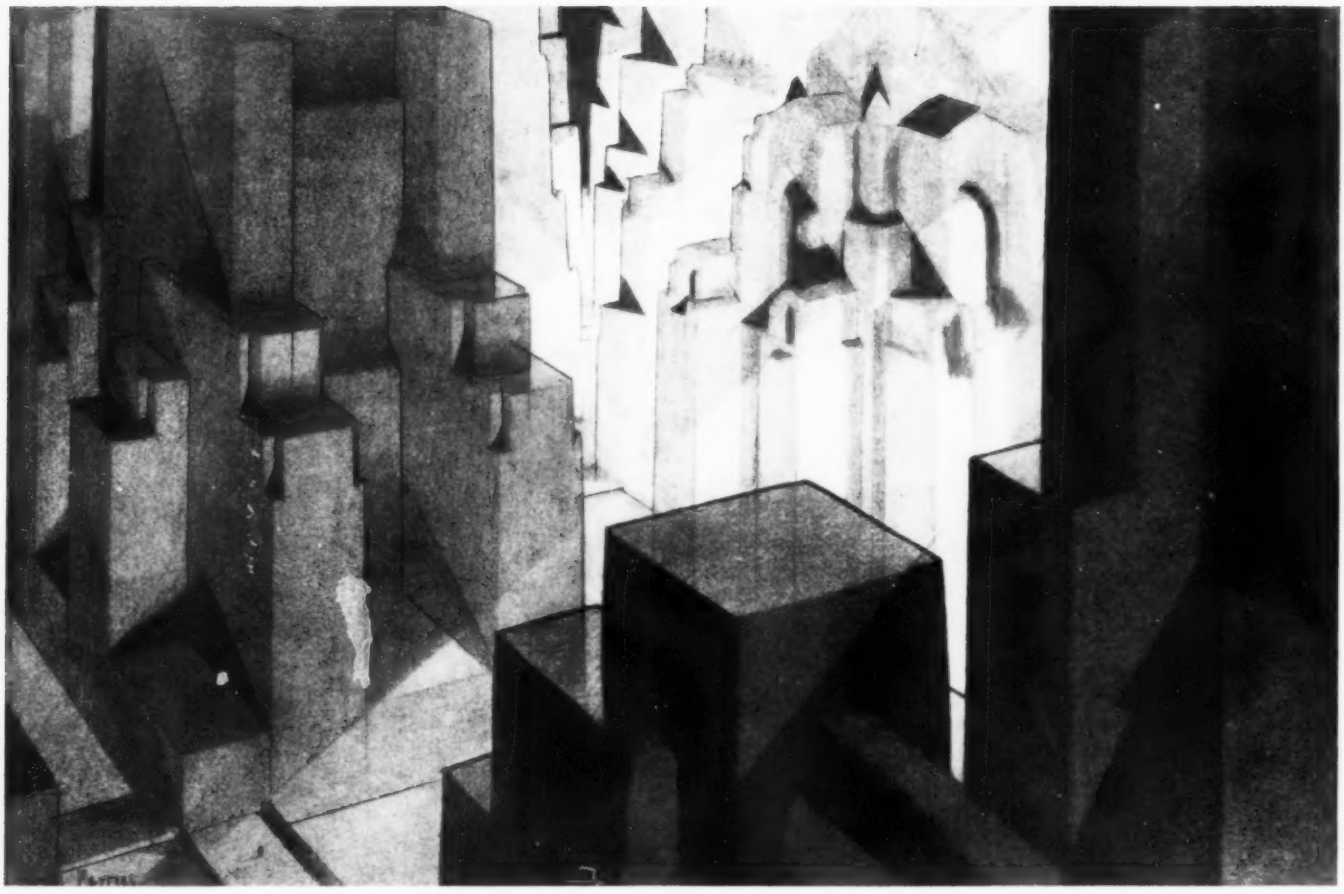
HORIZONTAL OR VERTICAL? A face of the Beaux-Arts Apartments in New York City is here turned both ways.

Horizontal or vertical "treatment" is quite at the discretion of the designer, since either is essentially a *surface* affair, not affecting the inside.

Note that in almost all "vertical treatments" a good half of the "piers" are structurally fake.

The Beaux-Arts Apartments with their broad windows make a step away from the idea of solid mass.

(KENNETH MURCHISON AND HOOD, GODLEY, AND FOUILHOUX, ARCHITECTS)



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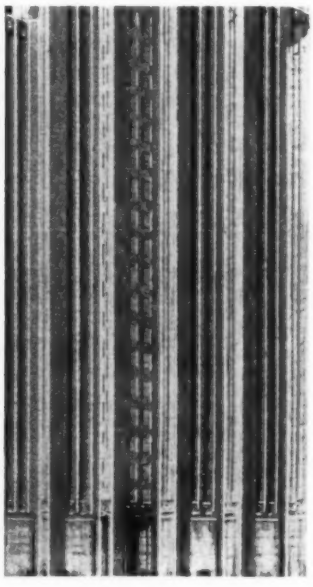

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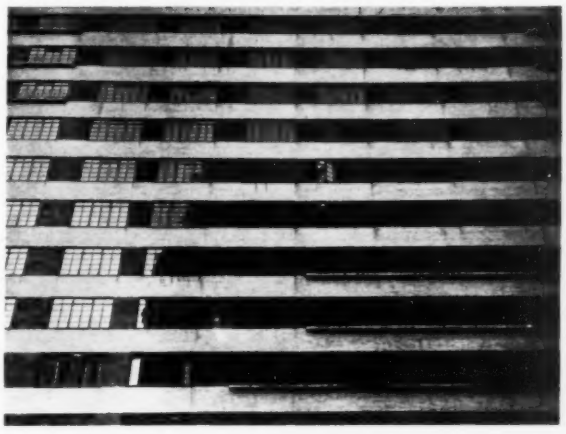

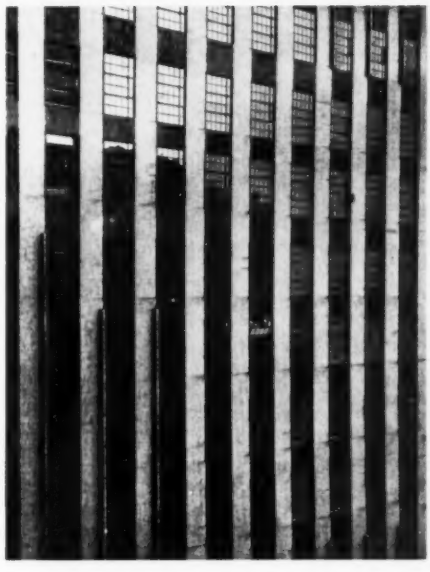

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The Beaux-Arts Apartments with their broad windows make a step away from the idea of solid mass.

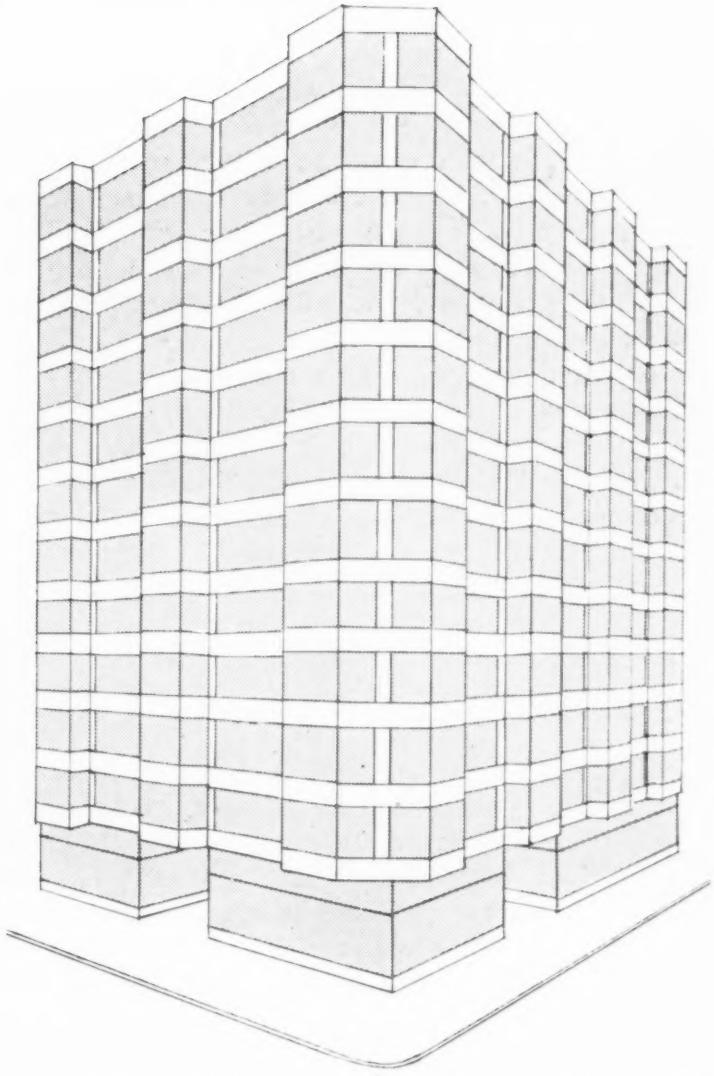
(KENNETH MURCHISON AND HOOD, GODLEY, AND FOUILHOUX, ARCHITECTS)

THE OLD TACOMA BLOCK, CHICAGO

HOLABIRD AND ROCHE, ARCHITECTS

Built in 1888–89

The sketch gives the essential system of the building without the ornament. "A brave affair that was all window, light, and air." Not a closed mass but an open volume. Note also that by confessing the "hung" nature of his building the designer avoided the difficulty with his store windows that attends putting them under solid pyramids.



it carries a straight analogy to the pyramid or the mausoleum. There, too, the windows are played down! Like those, our structures resemble large pieces of sculpture, grudgingly punctured by openings, which to no man's mind can have a deep significance.

Is there no better solution for a well-lit interior than to put it inside a statue and give it electric illumination? Or is electric light so complete a substitute for the light of day? Perhaps it will be; but for the moment we note that executives take the outer offices.

•

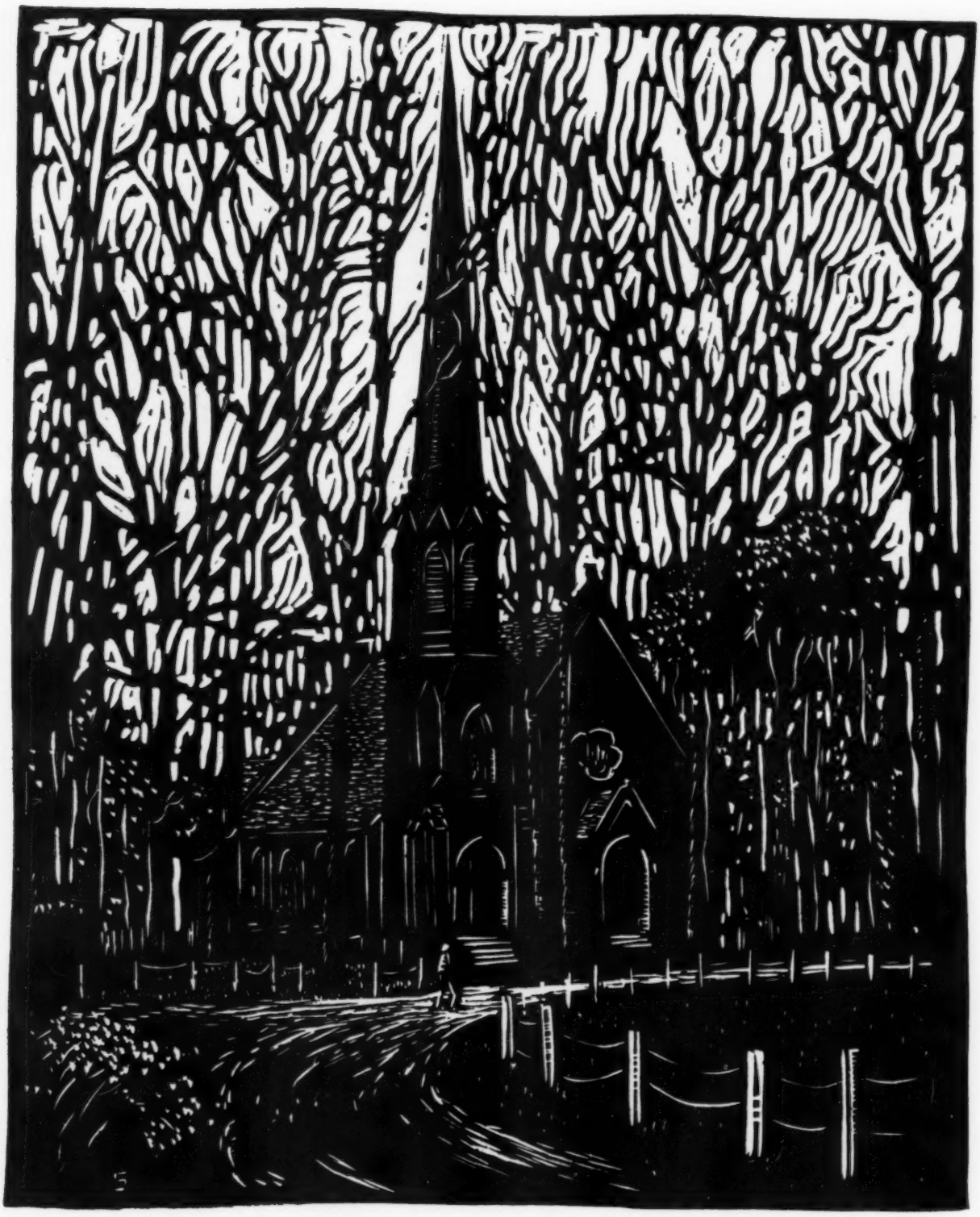
To compare the skyscraper with sculpture—carved, so to speak, out of the zoning envelope—is an exaggeration for the sake of truth. The practical exigencies are often exceedingly well met. But even when they are, the *expression* clings stubbornly to "mass." (The idea of mass persists even when a row of store windows at the bottom makes the pyramid as an analogy most embarrassing.) The idea of weight, material, dead tonnage. But is not this the age of the airplane and the suspension bridge? Is there no concept that would permit the designer to catch off his space lightly and deftly, and to face it with a mere veil?

DOUGLAS HASKELL.

THREE SCENES IN VIRGINIA

Linoleum Cuts by Charles W. Smith

Mr. Smith has made these records as an amateur —a lover, that is, of the art and of his adopted state of Virginia. The collection of prints is shortly to be assembled and published in a book.



SCENE IN VIRGINIA

LINOLEUM CUT BY CHARLES W. SMITH

SCENE IN VIRGINIA

LINOLEUM CUT BY CHARLES W. SMITH

Courtesy of the Weyhe Gallery

TAOS

THREE WOODCUTS BY HOWARD COOK

Born in Springfield, Mass., in 1901, Mr. Cook is still a young man, but he has already traveled through Europe, Turkey, China, Japan, and other countries, sometimes as a seaman. His drawing shows what Mr. Arno d Ronnebeck has characterized as a "grave yet lofty acuteness."

Mr. Cook's etchings, wood engravings, and lithographs, have been shown at the Denver Museum and the Weyhe Gallery (New York), and are represented in the permanent collection of the Metropolitan Museum.

Courtesy of the Forum Magazine

THE DICTATOR

WOODCUT BY HOWARD COOK

Courtesy of the Weyhe Gallery

SKYSCRAPER

WOODCUT BY HOWARD COOK

THE ARCHITECTURAL RECORD

TECHNICAL NEWS AND RESEARCH

APRIL · 1930

THE MINIMUM BUILDING FOR VARYING LAND VALUES

BY W. R. MORTON KEAST AND A. B. RANDALL

NEXT MONTH:
THE THEATRE

A NOTE TO THE READER: In the pages which follow will be found an innovation in the arrangement of reading matter and illustrations. Instead of the regular double-column page there is a single wide column carrying the "text"; all notes, graphs, and illustrations, are placed to the outside as marginalia. The reader will suffer no inconvenience, we believe, if he will but remember that all "footnotes" have become "side" notes. By this arrangement it has been possible to bring most of the illustrative matter next to that part of the article to which it refers, and leafing or hunting is reduced to a minimum.

Those interested in typography will note that there are no "run-arounds," or places where the reading matter has to assume odd shapes in making way for illustrations (since type and "cuts" are held separate); the actual area of the type approximates the average per page in the rest of the magazine; and the area of the illustrations is considerably increased. The page margin has been greatly reduced, and some of the "white space" thus gained now falls between the successive illustrations.

THE MINIMUM BUILDING FOR VARYING LAND VALUES

BY W. R. MORTON KEAST AND A. B. RANDALL*

On pages 378 and 379 are the tables around which this article has been built. The first of these tables indicates a method of analyzing building, land, and financing costs, given various values of land. The second gives a method whereby the architect may analyze his client's specific building project, allowance being made for variations in specific items. The article itself explains the elements that go into these two charts.

The multiplicity of factors involved, and their changing relationship, keep the situation in a state of flux, so that the data submitted with this article are not to be taken as final or as indicating a rule. Yet they give a picture that is fairly complete, and as accurate as careful study could secure.

BUILDING AT MICHIGAN AND GRAND AVENUES, CHICAGO
THIELBAR AND FUGARD, ARCHITECTS

* Mr. Keast is Economist, and Mr. Randall is Research Engineer, of the architectural firm of Simon, Philadelphia.

Acknowledgment is made of assistance given by Mr. John B. Lear, President of the Philadelphia Chapter of the Building Owners and Managers Association, by Members of this Association, and by Mr. F. H. Penson.

I. RATIO OF BUILDING COST TO LAND VALUE

ARCHITECTURE is not only a matter of good floor plans. Rather, these must go together with the appropriate economic solution. After all, economics itself strives, like art, to be an expression of right human relationships. And it is the architect alone who can correlate the economic with the engineering and aesthetic interests.

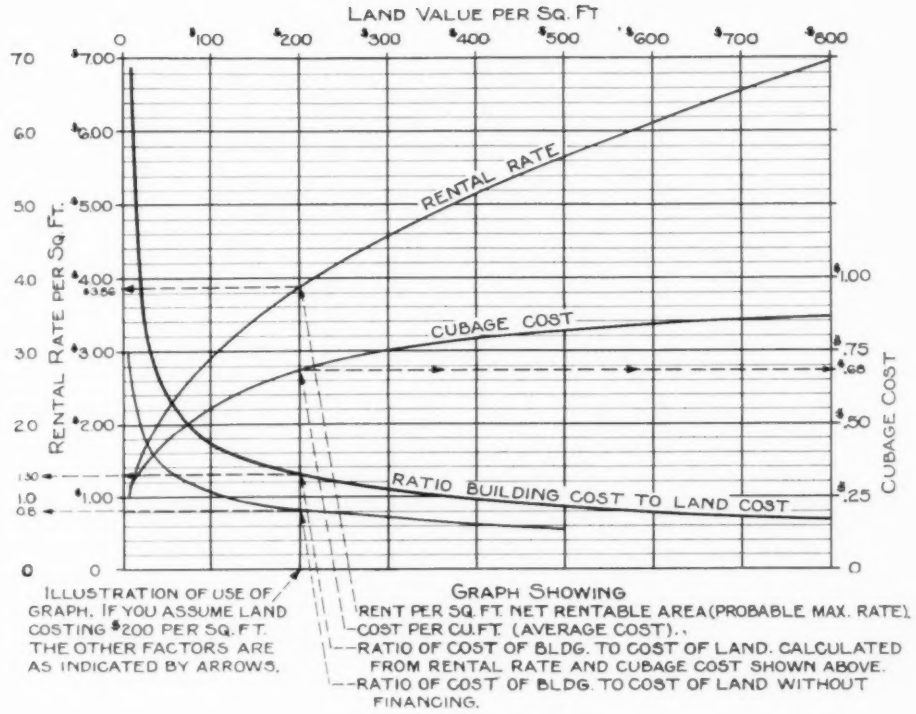
This study analyzes building ratios for present conditions and presents a method for determining an economic building adapted to future trends.

The minimum building—one which will earn 10% on an equity investment of about 20% of the total cost—is taken as a base. The advisability of building beyond this minimum size will depend on the present or probable future demand for space (See page 395).

A series of calculations similar to that on page 378 yields a ratio of building cost to land cost for each of the varying land values. This ratio is shown on the accompanying Graph 1. The heavy *ratio* line includes full financing, while the light line indicates a ratio with no financing fees included. It will be seen that, on the higher land values, profitable operation does not require a much larger building with the financing fees added than without; but on land at $100 or less per square foot the difference becomes very great, so that the fees sometimes double the size necessary for a profitable building.

The method of using this graph is as follows: First, on the known land value the ratio is taken and multiplied by this land value per square foot. This gives a building cost in dollars. This cost is then divided by the cubic foot price of the building, giving a resultant number of cubic feet. Dividing this number of cubic feet by the proper ratio of net area to cubic feet gives the number of square feet rentable. Subtracting the ground floor usable area of 7 square feet gives the balance necessary on the other floors. See pages 378, 379.

The capital cost can then be set up and the income and expense account should balance. The size of this ratio does not mean that the cost of building is greater on low land values than on expensive land values: i. e., on a land value of $100 per square foot, a building is


LAND VALUE PER SQ. FT
0 $100 $200 $300 $400 $500 $600 $700 $800
RENTAL RATE
CUBAGE COST
RATIO BUILDING COST TO LAND COST
RENTAL RATE PER SQ FT.
CUBAGE COST
ILLUSTRATION OF USE OF GRAPH. IF YOU ASSUME LAND COSTING $200 PER SQ. FT. THE OTHER FACTORS ARE AS INDICATED BY ARROWS.
GRAPH SHOWING
RENT PER SQ. FT. NET RENTABLE AREA (PROBABLE MAX. RATE).
COST PER CU. FT. (AVERAGE COST).
RATIO OF COST OF BLDG. TO COST OF LAND. CALCULATED FROM RENTAL RATE AND CUBAGE COST SHOWN ABOVE.
RATIO OF COST OF BLDG. TO COST OF LAND WITHOUT FINANCING.

GRAPH 1. RATIO OF BUILDING COST TO LAND VALUE

required costing one and three quarters times this land value, or $175 per square foot of land area. Assuming a plot of 10,000 square feet, the building cost would be $1,750,000.

On a land value of $350 per square foot the building cost and land value would be equal. Thus with a similar plot of 10,000 square feet a building cost of about $3,500,000 would be indicated.

It may be observed that a variation in any one factor will immediately require an equivalent equalizing variation in another factor or else the accounts will not balance. Land values and rental rates are interdependent factors of paramount importance. A variation of a cent or two in the rental rate will permit or require greater variations in other factors than a similar variation in the building cost or operating cost.*

•

The deductions from the ratio curve indicate the size of the minimum building for today only. Such a determination is the first step in the study. Additional factors, such as increase or decrease of land value, affect the final determination. Further analysis of requirements is given in the division on Changing Land Values.

•

No indication has yet been given of the number of stories required. The reason for this is that the number of stories on a particular plot to produce the same total rentable area varies with the coverage, and with the relationship of net rentable to gross areas.

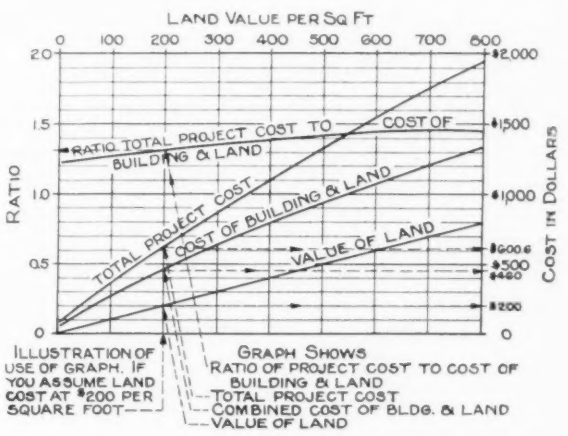
Coverage means *the proportion of the total plot area occupied by the gross area of the typical floor of the building.* (In a set-back building several typical floors are used.) Gross area is *the area included within the perimeter of outside walls. Net area means the rentable area obtained.*

Many factors influence the proper coverage of plot that should be used in any given case. These include the

*QUALITY VERSUS QUANTITY PRODUCTION OF SPACE

In this analysis, the rental rates and the quality of building on a certain land value have been given near the maximum, since this implies the minimum building. It is possible to consider—as in recent cases in New York—a cheaper rental rate as desirable. This immediately implies a correspondingly cheaper building cost, and a greater number of space units to rent—since the land cost must be divided over a greater number of cheaper productive units.

Therefore, although the rental rates are lower, implying lower building costs, yet the resultant building will of necessity be larger in size. Its total cost will be approximately that calculated for a maximum rental rate.


LAND VALUE PER SQ FT
0 100 200 300 400 500 600 700 800
RATIO TOTAL PROJECT COST TO COST OF BUILDING & LAND
TOTAL PROJECT COST
COST OF BUILDING & LAND
VALUE OF LAND
RATIO
COST IN DOLLARS
ILLUSTRATION OF USE OF GRAPH. IF YOU ASSUME LAND COST AT $200 PER SQUARE FOOT
GRAPH SHOWS
RATIO OF PROJECT COST TO COST OF BUILDING & LAND
TOTAL PROJECT COST
COMBINED COST OF BLDG. & LAND
VALUE OF LAND

GRAPH 2. TOTAL INVESTMENT FOR MINIMUM BUILDING INCLUDING FINANCING

		$5	25	50	100	200	300	400	500	600	700	$800
A	LAND VALUE											
B	Ratio	11.00	3.67	2.41	1.72	1.30	1.122	0.99	0.873	0.786	0.72	0.654
C	Building Cost	55.00	91.90	122.00	172.00	260.00	337.00	396.00	436.00	472.00	504.00	524.00
D	Cube Cost	0.27	0.36	0.45	0.55	0.68	0.75	0.79	0.81	0.83	0.85	0.86
E	Cubage	203.8	255	268	313	383	450	501	538	568	593	609
F	Cu. ft. per sq. ft. rent area	16.50	17.82	17.90	18.10	18.25	18.50	18.70	18.79	18.87	18.92	19.00
G	Total Area	12.33	14.27	15.00	17.25	21.00	24.30	26.80	28.65	30.10	31.30	32.00
H	Total Area Excl. First floor	11.63	13.57	14.30	16.55	20.30	23.60	26.10	27.95	29.40	30.60	31.30
J	Const'n. Rate Cu. Ft. per month	22.5	22.2	21.5	20.0	18.8	18.3	18.0	17.9	17.7	17.6	17.5
K	Const'n. Time in years	.753	.959	1.037	1.303	1.695	2.045	2.32	2.50	2.678	2.806	2.90
L	Ratio net rentable to plot area	.50	.50	.50	.50	.50	.50	.50	.50	.50	.50	.50
M	Number of Floors	23	37	39	33	41	47	52	56	59	61	63
N	Ground Floor Rental Rate	1.053	1.64	2.23	6.00	12.00	18.00	24.00	30.00	36.00	42.00	48.00
O	Office Rental Rate	1.053	1.64	2.23	2.87	3.86	4.60	5.18	5.65	6.11	6.56	6.93
CAPITAL COSTS												
A	LAND VALUE	5.00	25.00	50.00	100.00	200.00	300.00	400.00	500.00	600.00	700.00	800.00
C	Building Cost	55.00	91.90	122.00	172.00	260.00	337.00	396.00	436.00	472.00	504.00	524.00
Va	Taxes during Construction L.	.07	.47	1.00	2.51	6.52	11.82	17.88	24.10	30.90	37.83	44.60
Vb	Taxes during Construction B.	.40	.85	1.22	2.16	4.24	6.64	8.85	10.50	12.17	13.62	14.61
V	Int. dur. constr. inc. Tax Rfds.	3.85	9.65	15.48	31.42	71.72	123.80	180.50	233.20	290.20	346.70	398.00
W	Int. Credit on cash	.70	1.53	2.24	4.17	8.73	14.47	20.45	25.55	31.00	36.07	40.28
X	Net int. dur. Construction	3.15	8.12	13.24	27.25	62.99	109.33	160.05	207.65	259.20	310.63	357.72
Y	Fin. Cost	4.92	9.73	14.42	23.35	40.84	58.40	75.10	90.00	104.79	119.30	132.40
Z	Initial Vacancy Cost	3.90	7.02	10.02	15.51	26.03	36.35	45.60	53.68	61.42	69.05	74.98
S	Total Proj. Cost	72.44	143.09	211.90	342.78	600.62	859.54	1103.48	1321.93	1540.48	1754.43	1948.31
CAPITALIZATION												
a	1st Mortgage	47.10	93.02	137.50	222.74	390.39	558.50	716.50	859.50	1002.00	1141.00	1266.00
b	2nd Mortgage	10.87	21.42	31.83	51.48	90.19	129.00	165.50	198.30	231.00	263.00	292.31
c	Equity	14.47	28.65	42.57	68.56	120.04	172.04	221.48	264.13	307.48	350.43	390.00
S	Total	72.44	143.09	211.90	342.78	600.62	859.54	1103.48	1321.93	1540.48	1754.43	1948.31
INCOME												
P	Ground Floor	0.74	1.15	1.52	4.20	8.40	12.60	16.80	21.00	25.20	29.40	33.60
Q	Offices	12.24	22.25	31.89	47.50	78.35	108.56	135.10	157.92	179.60	200.78	216.40
R	Total 100% Occ.	12.99	23.40	33.41	51.70	86.75	121.16	151.90	178.92	204.80	230.18	250.00
T	Total 90% Occ.	11.70	21.06	30.06	46.53	78.07	109.04	136.74	161.03	184.32	207.16	224.94
EXPENSE												
-	Operat'g Rate	.27	.36	.45	.55	.68	.75	.79	.81	.83	.85	.86
d	Oper'g Expense	3.33	5.15	6.76	9.49	14.29	18.25	21.20	23.20	25.00	26.60	27.53
f	Taxes .01925	1.15	2.25	3.32	5.24	8.85	12.27	15.32	18.03	20.62	23.15	25.50
e	Insurance .0012	.07	.11	.15	.20	.31	.41	.48	.52	.57	.60	.63
g	Amortization	1.70	2.93	4.05	6.09	10.00	14.00	17.60	20.58	23.50	26.33	28.08
h	Int. Ernes. & Tax Rfds.	5.45	10.62	15.78	25.54	44.62	64.07	82.14	98.68	114.66	130.48	143.20
T	Total	11.70	21.06	30.06	46.56	78.07	109.00	136.74	161.01	184.35	207.16	224.94

On this Page: TABLE OF CALCULATIONS SHOWING A METHOD OF DEDUCING WHAT IS THE MINIMUM BUILDING FOR VARIOUS LAND VALUES

(Based on square feet of plot area and including financing costs)

On the opposite Page: THE ABOVE TABLE PUT TO USE IN CALCULATING A SPECIFIC PROJECT

($200 land value is used as an example)

PROJECT——————————Type of Building: Office Building

LOCATION——————Area of land: 15,000 sq. ft. Value of Land: $3,200,000.

Based on one square foot of plot.

GENERAL DATA

A.	Value of land per square foot	$200.00
B.	Ratio of Building to land Graph #1	1.30
C.	Building cost A x B	260.00
D.	Building Cost per cubic foot Graph #1	.68
E.	Number of cubic feet per sq. foot of land C/D	383 cu. ft.
F.	Ratio of cubage and rentable area Graph #6	18.25 cu. ft.
G.	Total rentable area E/F	21.0 sq. ft.
H.	Rentable area excluding ground floor G - .7 sq. ft.	20.3 " "
J.	Construction rate per month Graph #11	18.8 cu. ft.
K.	Construction time E/J changed to years	1.695 yrs.
L.	Ratio not rentable area on typical floor to plot area	50%
M.	Number of stories H/L	41 stories
N.	Ground Floor rental rate per sq. ft. 6% of A	$12.00
O.	Office rental rate Graph #1.	3.86

CAPITAL COSTS

A.	Land value		$200.00	
C.	Building cost		260.00	
U.	Taxes during construction (see page 390)			
	Ua. Land-70% x .0275 x K x A		6.52	
	Ub. Bldg-70% x .0275 x K x ½C		4.24	
V.	Interest dur. const. incl. tax refunds			
	Va. 7.0455% x K x S (page 391)	71.72		
*W.	Less int. credit on cash	8.73		
X.	Net int. dur. const.		62.99	
Y.	Financing cost 6.8% x S (see page 388)		40.84	
Z.	Initial Vacancy cost 30% x F (see page 384)		26.03	
**S.	TOTAL PROJECT COST			600.62

CAPITALIZATION

a.	1st Mortgage (@ 6%) 65% x S	$390.39	
b.	2nd Mortgage (@ 7½%) 15% x S	90.19	
c.	Equity (@ 10%) 20% x S	120.04	
	TOTAL CAPITALIZATION		600.62

INCOME

P.	Ground Floor .7 sq.ft. x N	$ 78.40	
Q.	Office rental H x O	8.35	
R.	Total income (@ 100% occupied P+Q	86.75	
T.	INCOME (@ 90% occupied		78.07

EXPENSE

d.	Operating cost G x rate (graph 13)	$14.29	
e.	Insurance C x .0012 (see page 389)	.31	
f.	Real Estate Tax (A C) x 70% x .0275	8.85	
g.	Amortization 2½% x (S - A)	10.00	
h.	Interest, earnings & tax rfds. 7.445% x S (see page 391)	44.62	
T.	TOTAL EXPENSE & EARNINGS		78.07

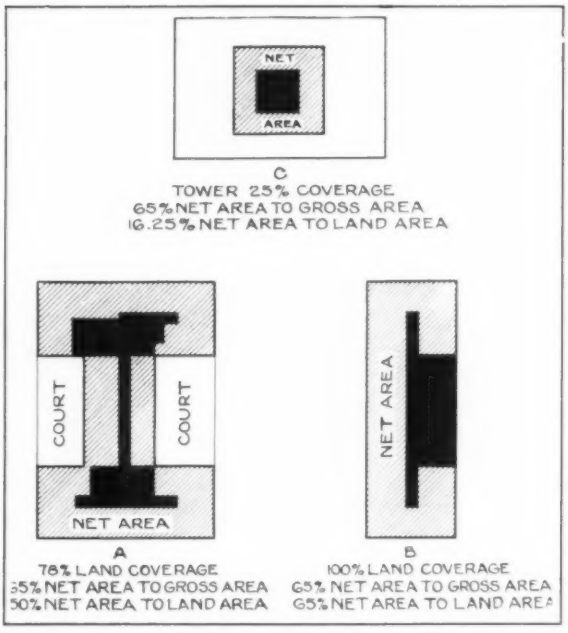
* Interest credit on cash held by trustee and paid out during constr.

S.	Total project cost		600.62
Y.	Less financing discounts Y.	40.84	
I.	" Equity discount 20% x S x K x 8%	16.30	
A.	" land value paid at start A	200.00	
k.	" Total deductions		257.14
m.	Balance cash held by trustee S - K		343.48
*W.	Interest credit 3% x m x K x ½		8.73

** DIRECT METHOD OF CALCULATING TOTAL PROJECT COST

This total cannot be secured by a direct calculation in the standard form since certain elements of the total are percentages of the total, which is unknown at this stage. To avoid several "cut and try" estimates the following method is suggested.

1.	Take sum of A+C+Ua+Ub+Z	496.79	
2.	Add ½ x A x 3% x K	5.09	
3.	Total of #1 & #2		501.88
	Add the following items in terms of % of S		
4.	7.0455% x K x S (int. dur. const.)		11.94%S
5.	Less int. credit on following:		
6.	1st mtge 65% S discounted @ .93	60.45 % S	
7.	2nd mtge 15% S " @ .85	12.75 % S	
8.	Equity 20% S less 20% S x K x 8%	17.29 % S	
9.	Total cash after discounts (6, 7, 8)	90.49 % S	
10.	Int. credit on #9—(3% x K x ½ x #9)		2.30%S
11.	Net interest during const. #4 - #10		9.64%S
12.	Financing discounts		6.80%S
13.	Total of items #11 & #12		16.44%S
14.	Net available % for items #3. (100% less #13)		83.56%S
15.	TOTAL PROJECT COST #3 / #14		600.62



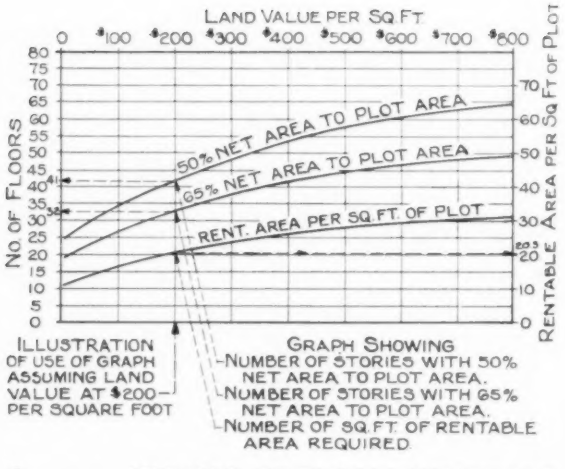
GRAPH 3. COVERAGE DIAGRAM

size and shape of the plot, and light and air conditions affecting rentals. Studies are required in order to compare situations where, on the one hand, a large coverage may be gained with poorer light and air and consequent reduction in average income, or, on the other hand, a smaller coverage may yield superior space. Offices of a greater room depth than 28 feet are not first-class office units and tend towards loft standards, with correspondingly lower rental values. With depths beyond this limit a higher ratio of net area to gross area may appear, but the reduction in value of such space may more than offset the apparent gain from the increased area provided.

Rental advantages are often gained by a higher building with less, but more valuable, space on each floor, and with progressively higher rentals on upper floors.

Records of office buildings indicate an average coverage of the land by the typical floor of about 78%. With the losses due to walls, corridors, elevators, and other service spaces, the normal ratio results of 65% *net* area to *gross* area. This gives a proportion of *net* area to *plot* area of about 50%. In special cases, with certain shapes of land, the gross area can cover the entire plot. In such a case the 65% ratio of net area to gross area will also be the ratio of net area to plot area. See Graph 3.

Using these ratios, a tentative indication of the number of stories may be obtained for the coverages shown. This is given in Graph 4 and may be adjusted for other ratios of coverage, or for partial variations, to give an approximate suggestion of the size of building required.


LAND VALUE PER SQ. FT.
0
$100
$200
$300
$400
$500
$600
$700
$800
NO. OF FLOORS
RENTABLE AREA PER SQ. FT. OF PLOT
50% NET AREA TO PLOT AREA
65% NET AREA TO PLOT AREA
RENT. AREA PER SQ. FT. OF PLOT
ILLUSTRATION OF USE OF GRAPH ASSUMING LAND VALUE AT $200 PER SQUARE FOOT
GRAPH SHOWING
NUMBER OF STORIES WITH 50% NET AREA TO PLOT AREA.
NUMBER OF STORIES WITH 65% NET AREA TO PLOT AREA.
NUMBER OF SQ. FT. OF RENTABLE AREA REQUIRED

GRAPH 4. NUMBER OF FLOORS NECESSARY

RATIO OF CUBAGE AND RENTABLE AREA

The rentable or usable area in a given building depends on many factors, among the principal of which are the size and proportions of the lot, the set-backs and light courts, and the space taken up by utilities. These factors determine what may be called plan efficiency, which is usually expressed by a *ratio of the net usable or rentable space to the gross floor areas.*

The plan efficiency of a typical office building with offices of proper depth will usually come to about 65% or 70% of the gross floor area. This ratio of 70%, applied to a typical office floor of 11′ 6″ height, shows that about 16.4 cubic feet of building are required per square foot of office area. In loft buildings this cubage may be considerably reduced, since there are no corridors and few facilities developed on the open undivided floors; and a ratio may obtain of 80 to 90% usable to gross area.

When any entire building is considered, the number of cubic feet built per square foot of rentable area developed will exceed the proportion shown above, which is based on *one floor only*. Construction cubage is required for the mechanical and boiler plant, elevator overruns, machinery and pits, pent houses, pipe, lofts, service employes' quarters, and storage space, roof and miscellaneous construction, and special extra-height floors. These factors make an appreciable increase in the cubage per square

foot of rentable area. Examples of office building construction demonstrate that this will vary from about 17.5 to 19.0 cubic feet per square foot of rentable area, depending on the building floor heights and upon the building size.

The cheaper buildings on cheaper land, carrying relatively lower rental rates, may be expected to have somewhat lower floor heights; while in the more expensive buildings, the reverse may be expected.

In larger and higher buildings, the utilities increase, and reduce the ratio of net to gross areas, tending to increase the cubage per square foot of rentable area.

Ratio of cubage to rentable area is shown in Graph 6.

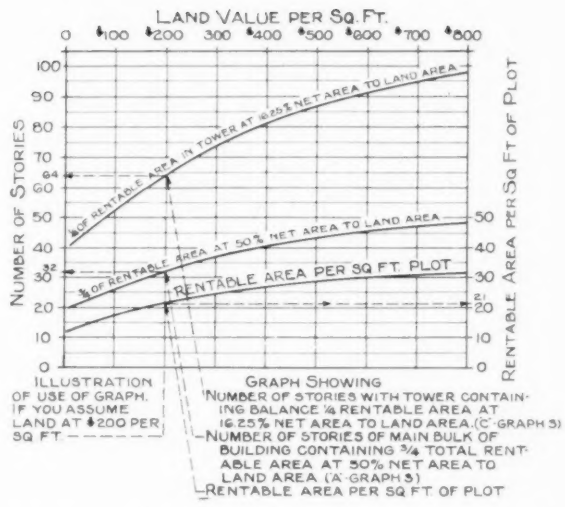
INCOME IN RELATION TO LAND VALUE

The income derived from office buildings is the rental (or rental value) of ground floor and other space. Rental value and land value are closely related. The same preference reflected in the land value has a resultant in rental value. It is easily understood that a land value of $50 a square foot, on the edge of a district, could not command the same rental return for space in a building erected on it as could land worth $300 per square foot.

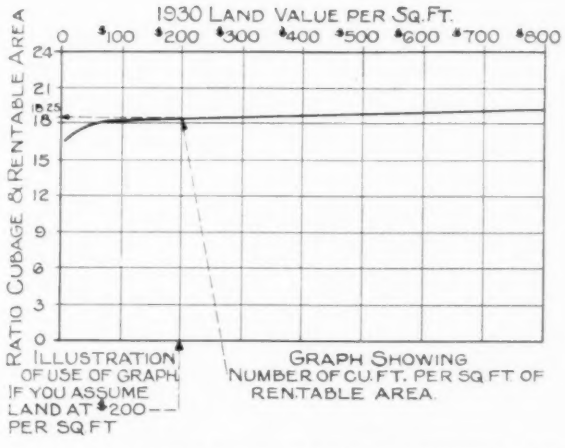
While this differentiation is very apparent in ground floor rental values, it has also a great effect on the rental rates of the office floors. Ground floor rentals, on the basis of a large number of examples, seem to average their space value at a rate of approximately 6% on the land value per square foot. Since the area rentable on the ground floor is only about 70% of the plot area, the product of 70% times a rate per square foot of 6% of the ground value gives a very close approximation to the income that may be expected from this source. There are some theories according to which the ground floor rental will carry the land including interest and taxes; but even the best examples actually analyzed in this study did not give returns greater than those indicated above.

In addition to the relation of land value to office rental rates, there is another factor present in the relative quality of the building. It is obviously improper to put a first-class building on third-class land; conversely it is necessary to erect a first-class building on first-class land in order to obtain maximum rates. With the proper quality of building, therefore, the rental of offices on varying land values, and their relation to each other, have been plotted on Graph 5. The curve shown is placed at the *maximum* rental probable in a building on a given site value, in order that the analysis may show the *minimum* size of building required.

Rental rates for offices are subject to variation based upon exposure and upon the height above the street. Rentals for spaces lighted by courts are often much lower than those on the outside; space on higher floors brings a markedly better rate than equal space on lower floors. Graph 6 indicates in a general way the variation of the average rental rate per floor for similar floors in a typical office building. The peak or rise of rate value at the center represents the floor where two express and local

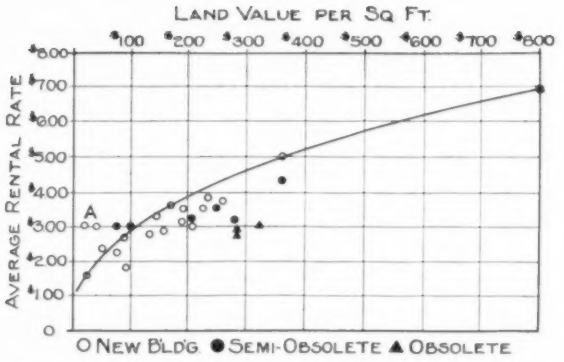

LAND VALUE PER SQ. FT.
0 $100 $200 300 $400 $500 $600 $700 $800
NUMBER OF STORIES
RENTABLE AREA PER SQ FT OF PLOT
% OF RENTABLE AREA IN TOWER AT @25% NET AREA TO LAND AREA
% OF RENTABLE AREA AT 50% NET AREA TO LAND AREA
RENTABLE AREA PER SQ FT PLOT
ILLUSTRATION OF USE OF GRAPH. IF YOU ASSUME LAND AT $200 PER SQ FT.
GRAPH SHOWING
NUMBER OF STORIES WITH TOWER CONTAINING BALANCE ¼ RENTABLE AREA AT @25% NET AREA TO LAND AREA. (C-GRAPH 3)
NUMBER OF STORIES OF MAIN BULK OF BUILDING CONTAINING ¾ TOTAL RENTABLE AREA AT 50% NET AREA TO LAND AREA. (A-GRAPH 3)
RENTABLE AREA PER SQ FT OF PLOT

GRAPH 5. NUMBER OF STORES IN A TOWER BUILDING


1930 LAND VALUE PER SQ. FT.
0 $100 $200 $300 $400 $500 $600 $700 $800
RATIO CUBAGE & RENTABLE AREA
ILLUSTRATION OF USE OF GRAPH. IF YOU ASSUME LAND AT $200 PER SQ FT
GRAPH SHOWING NUMBER OF CU. FT. PER SQ FT OF RENTABLE AREA

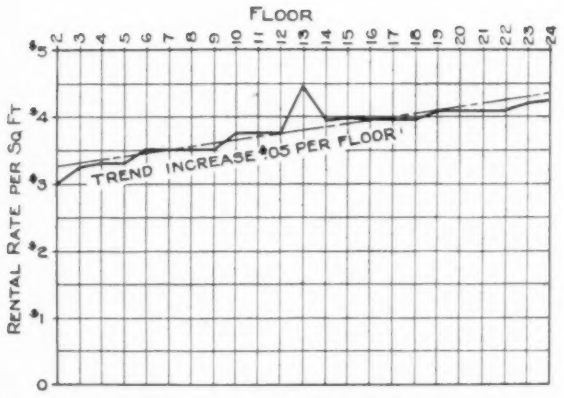
GRAPH 6. RATIO OF CUBAGE TO RENTABLE AREA

From the study of a group of buildings this graph was drawn as exhibiting the most reasonable average assumption for the relationship between rentable or income-producing area and the cubage necessary to develop such areas. This relationship depends upon office depth, ratios of net to gross areas, floor heights, and provisions for utilities and services. On cheap land of low rentals it is obvious that lower ceiling heights will be usual, while on land of intensive value with high rents the reverse should hold. Further, in very large and high buildings, the utilities including vertical transportation facilities will tend to increase the cubage required to develop a unit of rentable area.


LAND VALUE PER SQ FT
$100 $200 $300 $400 $500 $600 $700 $800
AVERAGE RENTAL RATE
$800 $700 $600 $500 $400 $300 $200 $100 0
A
O NEW BLDG. ● SEMI-OBSOLETE ▲ OBSOLETE

GRAPH 7. STUDY OF ACTUAL RENTAL RATES. *Method used to determine probable maximum average rental rate for all floors of an entire building (except first floor).*

It is noteworthy that two buildings on low land values with rental rates far in excess of the probable maximum shown have had over the last five years a vacancy of much over 25%, thereby causing losses of proper returns to the owners. Further they are still so far out of line that obsolescence will render the buildings valueless before their present rates are warranted by increased land value.



GRAPH 8.
Preference of tenants for the upper floors of office buildings is indicated in the increasing trend of average floor rental rates (excluding the first floor). The peak shown at the 13th floor indicates the location of the transfer floor served by more than one group of elevators.

banks of elevators give accessibility from both the upper and the lower zones of the building.

Where there are undivided floor areas of abnormal depth, as in loft buildings and in certain of the lower zones of office buildings, the ratio of net area to gross area is larger than in first-class buildings. Rental rates should then be weighted. For instance, in a loft building of 85% net area to gross area, an office rate of $2.48 per square foot would be equivalent to a rate of $3.24 per square foot on a ratio of 65% net. Due weighting must be made in such areas for these factors.

II. FACTORS USED IN COMPUTING MINIMUM BUILDING

Owners are often misled by omission of items of "capital" cost.

It is extremely important to an owner to know accurately all costs that will enter into the "change-over" contemplated on his property. If all of these costs are not included in the financial plan, and additional capital is later required, an owner may be forced to refinance, thus adding additional fees and costs to his project. This often results in disaster, since the project had not been planned to cover the interest and other charges on these additional costs.

ITEMS OF CAPITAL COST

LAND VALUE. (See also Section III on Land Values.)

This includes all real estate, transfer, and legal fees, title insurance, and carrying costs involved up to the point of demolition for the new project. Ground is usually purchased on the basis of the front foot. Ground floor space is likewise often evaluated by frontage. However, practically all other space is based on the square foot, as are also building costs and operating expenses. It has, therefore, been found most convenient to use the basis of one square foot of land value.

BUILDING COSTS

These include all items pertaining to the construction of the building, including contractors' fees, surety bonds, insurance during construction, architect's and other professional fees. Data collected from a large number of office buildings indicate a variation in costs—from 50 cents to upwards of 85 cents per cubic foot. These are exclusive of such interior decoration as may be added by ground-floor or other tenants, which in the case of a bank, for instance, may amount to a large sum, but which is fairly charged to business requirements exclusive of the space-value of the building. On the less expensive land, buildings costing less than 50 cents a cubic foot pass into loft, warehouse, and garage classes, and continue down to 20 cents a cubic foot as shown.

The accompanying Graph 9 gives a fair comparison of building costs relative to land values, with examples of buildings plotted thereon. The curve shown has been used as a basis of calculation for average building costs on varying land value.

CARRYING COSTS DURING CONSTRUCTION

These are a necessary cost and capital charge, and enter into the cost of every new building development. From the commencement of demolition to the occupancy of the completed structure, interest must be paid or accounted for on all money expended in the project. If the customary method of a first mortgage bond issue, followed by second mortgage bonds and the balance of equity money, has been employed, interest must be allowed on all these various parts, although a certain credit is allowed on that portion of the cash held by the trustee and paid out by him as the work progresses. State and federal tax refunds are also to be included for this period.

Taxes must be paid on the land assessment during the entire time of the construction of the building. The building assessment will gradually increase over the time of building until at its completion a total assessment is reached. The average of building taxes will therefore be based on one-half the final building assessment over the period of construction.

The time of construction of a large building will vary from less than a year to upwards of two and a half years in certain cases, commencing with demolition and continuing up to the time of opening, ready for tenants. The construction records of a group of representative buildings were analyzed and plotted and the accompanying Graph 10 indicates the average results. It was to be expected, of course, that the less expensively finished types of buildings would be erected at a speedier rate and in a shorter period than expensively finished buildings containing a higher quality of materials, and refinements of workmanship.

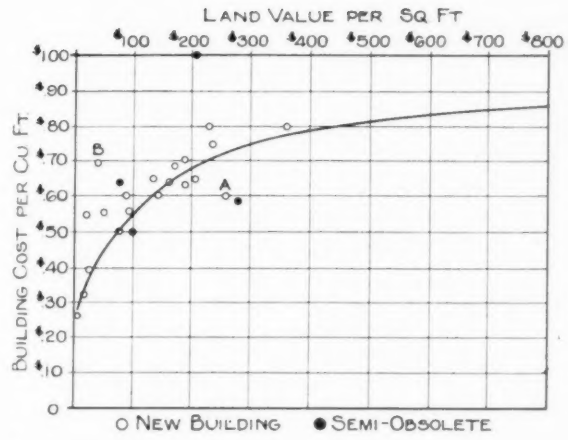
IMPORTANCE OF RAPID CONSTRUCTION

When one considers the mounting interest and tax costs, the importance of rapid construction cannot be overestimated.

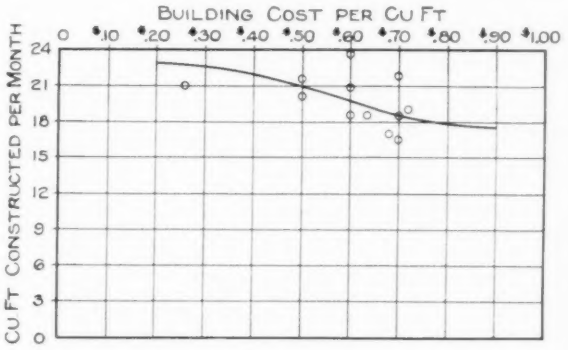
When buildings become of such size that the time of construction is a factor of great importance in cost, this time may be reduced by the use of additional shifts of workmen.

Some of the speeding can be effected by the delivery of materials at times other than the rush hours on the streets, and this saving has been included in the calculations. The doubling or tripling of shifts may possibly be carried further. The additional costs involved must not exceed the saving made on interest and taxes over the time involved.

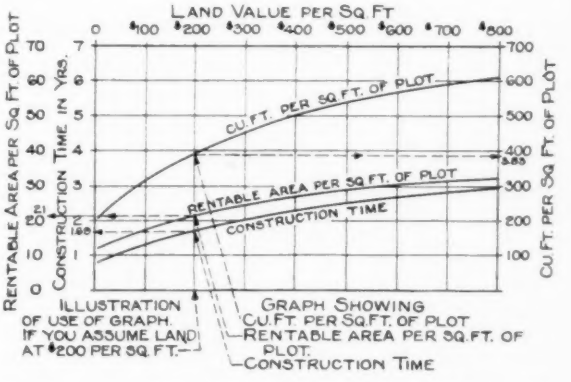
It must also be remembered that some construction records exclude time of demolition, and sometimes even time required for foundations, and only include construction to the time of installation of the first tenant in a particularly favorable location. The time factor included herein has been that upon which interest cost must be based and includes the other items as well as the superstructure of the building. (Graph 11.)


LAND VALUE PER SQ FT
$100 $200 $300 $400 $500 $600 $700 $800
BUILDING COST PER CU FT
$100 $90 $80 $70 $60 $50 $40 $30 $20 $10 0
B
A
○ NEW BUILDING ● SEMI-OBSOLETE

GRAPH 9.
Showing plottings of representative office buildings in several cities, the majority of recent date of construction. The older buildings are plotted, allowing for changes in costs between their construction dates and the present year.



GRAPH 10.
Records of a group of buildings are plotted here on the basis of construction per month per square foot of plot area, as giving more accurate results than those of total cubage or dollar value of construction, or floors per month.

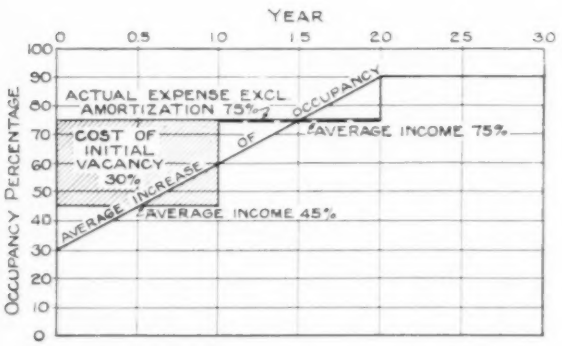

LAND VALUE PER SQ FT
0 $100 $200 $300 $400 $500 $600 $700 $800
RENTABLE AREA PER SQ FT OF PLOT
CONSTRUCTION TIME IN YRS.
CU FT PER SQ FT OF PLOT
RENTABLE AREA PER SQ FT OF PLOT
CONSTRUCTION TIME
CU FT PER SQ FT OF PLOT
ILLUSTRATION OF USE OF GRAPH. IF YOU ASSUME LAND AT $200 PER SQ FT.
GRAPH SHOWING CU FT PER SQ FT OF PLOT
RENTABLE AREA PER SQ FT OF PLOT
CONSTRUCTION TIME

GRAPH 11. CUBAGE: RENTABLE AREA AND CONSTRUCTION TIME FOR MINIMUM BUILDINGS

Photo. Luckhaus Studio

WILSHIRE PROFESSIONAL BUILDING, LOS ANGELES

A. E. HARVEY, ARCHITECT



GRAPH 12.

This graph represents a comparison of an average increase in occupancy with the expense excluding amortization for the first two years after opening. A deficit of income to meet the expense in the first year is indicated, which may be evaluated as approximately 30% of a year's possible income, based on 100% occupancy.

The second year should balance, excluding amortization, while the subsequent years until obsolescence should not only cover amortization, but yield the minimum 10% return on the equity which is assumed as the least return attractive to owners.

INITIAL VACANCY COST IS OFTEN OVERLOOKED

This very important cost of "change-over" involved in new construction is frequently overlooked. The owner may realize that the loss incurred from the time demolition starts on the old building until the new building is ready for occupancy should rightly be charged as a cost, yet it is frequently forgotten that this loss or cost continues until such time as the building has reached occupancy and a resultant income which will meet all expenses.

In the period of demolition and construction the costs include taxes on the land and building, interest, and State and Federal tax refunds. In the subsequent period when the building is partly occupied there are added full taxes, the costs of operation, and insurance. Amortization is usually postponed until after the first or second year.

The danger of overlooking the initial vacancy costs is a serious one for an owner who cannot unexpectedly add to his equity investment but must needs meet this additional cost by additional financing. The costs of such refinancing are increasingly heavy and add considerably to the capital costs. Further the carrying charges involved often result in a building that is too small to give a proper return on this increased capitalization.

There are few buildings which attain or hold an occupancy of 100% for any considerably period. Study of office building occupancy shows that the normal average is about 90%, but that this is seldom attained the first year or two. Apartment houses are seldom estimated for normal occupancy of more than 80%, and hotels about 70% to 75%.

A study of a group of buildings built in good districts and held at general market rentals showed an average occupancy at opening date of approximately 30%, secured during the period of construction by renting from the plans. At the end of the first year this would increase to about 60% and the following year to the normal 90% occupancy. This indicates an average occupancy the first year of 45% and the second year of 75%.

A study of the costs that must be met during this period gives a total of about 75% of the possible income, i. e. the rent from 75% occupancy. These costs include operating costs, insurance, taxes, interest, and a risk value of 8% on the equity money for its use over this period. (Amortization is not charged the first year or two. It can be postponed until normal occupation is reached.)

The first year's income of 45% consequently falls short of the costs (75%) by an amount equal to 30% of the total possible income. The second year the accounts approximately balance (see Graph 12).

FINANCING

The total capitalization of an improvement is usually made of *first mortgage*, *second mortgage* and *equity* under a variety of names and forms. In some cases the equity holders are given a form of *third mortgage bonds* along

with common stock. The investment is covered by these bonds and any increment in the value of the property is reflected in the value of the no par stock. Certain other methods of financing with preferred stock have been used.

Financing a project by means of mortgages or mortgage bonds is usually accomplished by one of two general methods. The first is through a *trust company mortgage*, and the second by means of a *bond issue* through investment bankers. There are various types of intermediate methods including the case where a first mortgage is obtained as in the first method, followed by a second mortgage from a building and loan association or similar institution. Such an intermediate method would cost the owner financing fees upon a portion of the capitalization only.

The *trust company* or *institutional first mortgage* is often arranged without financing fees or discounts and is usually granted 60% of an appraisal made by the trust company. This appraisal often does not allow for certain items which enter into the actual cost of the change-over, such as interest during construction on second mortgage and equity value, initial vacancy cost, and architects' and other professional fees. Therefore this 60% of their appraisal becomes less than 60% of the actual total costs.

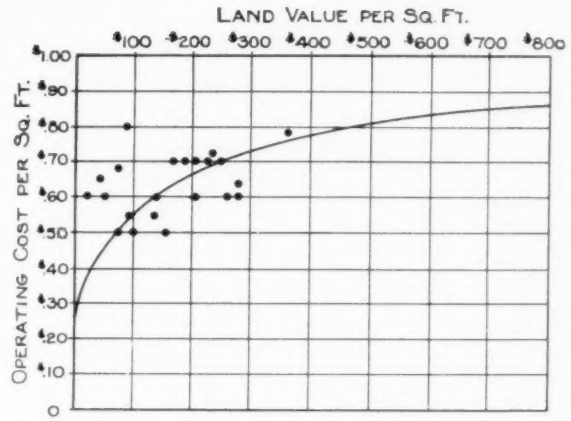
The bond issue on the other hand is often made upon an appraisal which includes these items and fees in the total costs of the change-over, or on an income basis capitalized, which is substantially equivalent. The security of the real estate permits a first mortgage up to 65% of the total appraisal in New York and other states. The second mortgage and equity are therefore smaller than required under the first method.

It may be observed here that the choice between these two methods depends rather upon special factors affecting the owner. The trust company, since most of its funds are under the jurisdiction of an orphans' court or other legal tribunal, and in fact are estates of one kind or another, usually requires a greater protection in the amount it will loan than the investment banker, who takes the slightly greater risk of the larger issue.

It is therefore not intended to suggest one method as against the other, but rather to figure with the one which costs the most, so that, although these costs may not be required at first, the project will still be in safe ratio to the land value should they be necessary later.

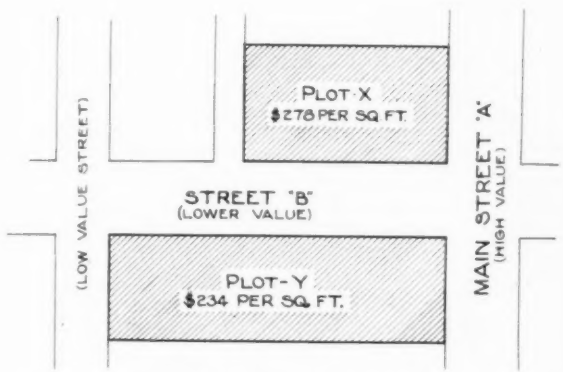
It is also noted that on high values of land the mortgages become of such size that few companies are large enough to take them alone, or willing to forego the consequent diversification of their funds.

Note that in the *lower range* of land values (from $1 to $100) the extra size necessary in the building to compensate for full financing is so great that the tendency here is toward the *trust company's mortgage* method. The trust company can take the entire mortgage without endangering the diversification of its investments, because the amounts involved are small.



GRAPH 13. OPERATING COSTS PER SQUARE FOOT ON VARYING LAND VALUES

Showing the line of mean operating costs



GRAPH 14. VARIATION IN LAND VALUE DUE TO DIFFERENCES IN FRONTAGE

Photo. c. Fairchild Aerial Survey

THE SHIFTING CITY SCENE. The Grand Central district in New York City in 1922. Compare it with the same region in 1929, as shown opposite

Bankers must eventually take a broader responsibility to the community, and to other investors than those applying to them. An individual borrower may have sufficient resources to cover a project which from the standpoint of the community represents inadequate utilization of land, or, conversely, serious overbuilding.

Full financing should be used on high land values.

In this analysis the second method, namely that of the *bond issue* and complete financing, will be considered as a fundamental one, and as a proper economic basis upon which a large structure should be designed. The reasons for this include the fact that even though the owner may not elect complete financing, the relation of the risk values of the various parts of the investment are better expressed in this method than in the other.

Only a minority of owners are in the position of having the capital themselves, and should they elect thus to finance a project (without allowing for financing charges in determining its size) this decision may easily work to their future detriment, should they ever desire to sell the land and its improvement. The prospective purchaser, should he require financing, as the majority do, will find that he has to add these costs to his capital

Photo: © Fairchild Aerial Surveys

THE SHIFTING CITY SCENE. The Grand Central district in New York City in 1929. Although such an expansion in the buildings of a region is tremendous, the prudent operator realizes that some of the most imposing statistical summaries of it are not to be taken at face value. This is due in part to the shifting purchasing power of the dollar itself, discussed on page 391. "Land that has apparently doubled in value over the last 25 years has actually remained only static in worth, since the dollar will buy only one half of what it did 25 years ago"

expenses when he takes over the property. If therefore the property improvements are designed to produce the requisite return on only a lesser capitalization without financing costs, this rate of return will obviously be less on a greater capitalization with new financing costs included. Such a condition actually implies a lesser value of the property to this majority of purchasers, and a probable loss in resale value to the original owner.

Should the present owner himself desire at any future time to obtain full financing on his property, this basis of calculation will provide him with a proper size of building without loss to himself.

Further, in very large projects, the granting of a mortgage by one institution may mean such a large sum that such institution will be unwilling to forego the principle of diversification of its investments and hence limit the application of the former method of financing.

One type of complete financing may enable an owner to obtain bond issues up to about 80% of the total project cost. These issues will have a cost varying with the conditions of the money market and with the prestige of the project and its owners. However, the average risk values of the various parts of the money

DETAIL FROM PRELIMINARY SKETCH OF APARTMENT IN CHICAGO
BOWMAN BROTHERS, ARCHITECTS

entering into the capital cost of the improvement may be expressed as follows: A first mortgage of 65% of the total appraisal at 6% interest and with financing fee or discount of 7 points, yielding a net of cash of 93% of the face value of the mortgage; a second mortgage of 15% additional at 7½% interest (whether obtained by premiums, discounts, or straight interest), at a fee, or discount of 15 points yielding cash of 85% of its face value.

Thus the total financing discounts can be expressed as the sum of 65% of the total at 7 points or 4.5% of the total capitalization, and 15% of the total at 15 points or 2.25%, making the total discount fees equal 6.8% of the total capitalization.

ANNUAL OPERATING EXPENSE

Operating expense, usually figured on a basis of cost per square foot of rentable area in a building, includes the following items: Cleaning and janitor service; heat, light, and power; elevator operation, ventilating, minor alterations, decorating and building repairs, and insurance exclusive of fire insurance on the building.

The Building Owners and Managers' *Experience Exchange Reports* indicate a range of cost from about 50c. to $1.00 per square foot rentable area per year, obtaining for a large number of buildings of all ages and in many cities. A study of this item as applied to known buildings indicates clearly that as land values and rentals increase, operating costs may be expected to increase, better service being demanded by the tenants. Operating costs too are greater in an old building than in a new building. A study of a group of representative buildings suggests that the operating cost in cents per square foot of rentable area is substantially close to the building cost in cents per cubic foot. Graph 13 illustrates the trend of operating costs that may reasonably be expected in buildings suggested on land of varying values. (Page 385.)

TAXES

These may be divided into two general classes, that of the *city* or *real estate tax*, and other taxes such as the Federal Income Tax of the owner, or certain state and federal tax refunds on the bond issues. This last item is best considered with the interest costs. The income tax of the owner has not been included in this study.

The *real estate tax* consists of two principal factors, the total tax rate and the basis of assessment. From general observation, an average of $2.75 per $100 of valuation assessment, and an assessment basis of about 70% of the value of the building and land value, have been taken as representative of the general cross-section. This rate as well as the basis of assessment may vary somewhat, but the product of these factors seemed generally to converge.

Taxes as applied to the project during construction have already been discussed under the head of carrying charges during construction.

INSURANCE

This cost is one of the smallest in the annual budget, but warrants consideration since a variation may involve a large sum-total for the life of the building. When a section or zone devoted to garage use is included in the building, or some other use that is considered more hazardous than offices, the insurance rate may be expected to increase. An instance is known where the inclusion of certain garage floors resulted in a rate of about 30c. per $100, while in another instance, of a building with a low hazard, the rate was less than 10c. In this study an average rate of 12c. per $100 has been taken as a reasonable average for office buildings.

AMORTIZATION

The tangible factors limiting building life have been termed *depreciation*, or a gradual physical wearing out of the building's component parts. The intangible factors have been termed *obsolescence*. These include changes in style, uses, and customs, advances in the art of construction which render the old building less desirable to tenants, losses in light and air due to the construction of neighboring buildings, and losses due to *inadequacy* or other causes.

Inadequacy is of paramount importance since it may cause a building to become valueless even though physically still excellent. Land value may have increased twofold to fivefold, with a corresponding increase in tax burdens and interest value. Rentals may have increased, but not proportionately, since competition from newer buildings tends to force rentals from obsolete buildings downward. Net income eventually disappears; the building has become obsolete due to inadequacy and must be replaced.

INCREASES IN LAND VALUE DO NOT ELIMINATE NECESSITY OF OBSOLESCENCE FUND

A view has been frequently expressed that there is no need to set aside a sum to meet building obsolescence because the decrease in value of the improvement is offset by the increase in value of the land. This is based, upon the fallacy that land is always increasing in value, and at exactly the same rate as the building diminishes. This assumption by an owner is likely to lead to disaster.

However, even though this depreciation happens to be balanced by land-value appreciation, with the result that after a given period of years the original equity value in dollars remains intact, there is another aspect of the situation far more important which is often overlooked.

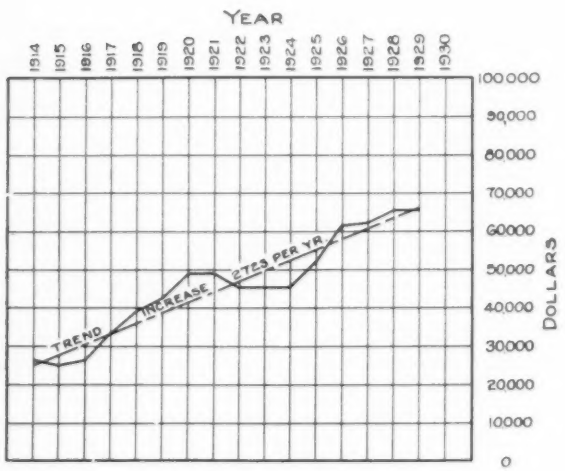
With increasing land value the owner may find that his original equity, however carefully preserved, is absolutely inadequate to build the size and type of structure that is required on the *new* land value.

The owner must therefore not only preserve his equity investment intact, as a sum of money, but must preserve its ratio in such a proportion that at all times he retains his original ability to build. (See "Economics of the Land," page 392.)

Photo. Moulin

PRELIMINARY SKETCH
THE SHELL BUILDING, SAN FRANCISCO
GEORGE W. KELHAM, ARCHITECT

REPLACEMENT COSTS are at a minimum in a new structure, and tend to increase progressively with time. These costs must be added to the capital account. However, there is not the advantage of compound interest to any large extent, as is found in obsolescence accounts. Depreciation will occur on many of the elements of a building to an extent of one or several replacements over its economic life. Items of foundations, structural steel, concrete, brickwork, and facing; permanent partitions, exterior finish, and the like, are usually more durable than the economic life of the building. Parts of roofing, mechanical equipment, elevators, electric work, heating and ventilating, are likely to require partial replacements over certain periods. Minor repairs are usually attended to under current operating charges, but major replacements or improvements are often made to keep up with increased demands for service.



GRAPH 15. TAX INCREASES
A study of taxation over a period of years indicates a fair increase in the costs of government. This graph shows the increase in taxation on a central Philadelphia property is also applicable to nearly every other city. Composite studies for future buildings will of course make proper allowance for such costs, in order to proportion the results to a minimum of losses, whether expressed in the capital or in the income account.

* This is not a basis to be used for income-tax purposes since most buildings are inadequate to the land and hence require a greater amortization than one properly proportioned.

MAINTENANCE OR DEPRECIATION

In general it is not unlikely that sums totaling about 30% of the initial building cost will have to be expended in the 25 to 35 years of a building's life, to maintain it in a satisfactory state to retain tenants. This would result in an estimated average allowance of about 1% of the project cost, less land, per year, for depreciation maintenance and replacement. (See note at left.)

A certain outstanding building has published accounts giving the expenditure on renewals and replacement per year as a little over one-half of one per cent of the building's cost. This building is exceptional in many ways and is balanced by others which set aside slightly more than one per cent per year.

Thus the sum-total allowance in buildings of economic proportion, for both obsolescence and maintenance, may be taken at 2½% of the total project cost exclusive of the land.

Of this 2½% per year, 1% should go to replacements, and 1½% should be set aside as a sinking fund bearing at least 5% interest compounded, for obsolescence.

Should the bond-holders or bankers require a larger amortization of mortgages than is here outlined, the additional part of the sum is actually a surplus account taken from equity income and reinvested in the property, and is over and above the sum actually required for maintenance of the investment and equity ratios.

INTEREST EARNINGS AND TAX REFUNDS

The interest payments include interest on the first and second mortgages with additional costs for tax refunds paid at the source.

The rate of the first mortgage may be taken at 6% per year. Favorable conditions may reduce this slightly; however, other factors such as the type of building, its character and quality, may increase the rate due to increased risk. Hotel and apartment projects are possible examples of this.

The risk of the *second* or *junior mortgage* is greater than that of the first, and this is reflected in the interest rate. A fair average of 7½% interest per year may be taken as a general cross-section, although this in name is not universally applicable. In states where a lower legal limit is set for interest rates, it is customary to obtain compensation for the increased risk of the second mortgage by means of additional fees, discounts or premiums, as in building and loan associations.

Equity earnings, which may be considered as an interest cost to be met annually, have been set at a minimum of 8% during the construction and the initial period of the building, and at 10% thereafter. This was considered the least that would reasonably attract investors, with the risk involved. The minimum building has been calculated on this basis. Larger buildings would sometimes increase this rate under advantageous conditions, and would thus provide more attractive propositions.*

The tax refunds, when paid at the source by the owner,

are practically an additional payment for the bond holders. The Pennsylvania State Tax is typical of the state taxes: it is four mills on the bond issue, which may be substantially 80% of the project cost. The Federal Income Tax Refund amounts to 2% on the mortgage bond interest.

The total of interest, equity value, and tax refunds during construction, may be added together as follows:

First Mtge.	6 %	on 65% total	is equivalent to	3.9 % total
Second Mtge.	7½%	on 15% "	"	1.125 % "
Equity value	8 %	on 20% "	"	1.6 % "
State tax at	.004	on 80% "	"	.32 % "
Federal tax	2%	on int. 1st & 2nd Mtg. 5.025%	is	.1005% "
		Sum of costs above is equivalent to		7.0455% of total

The interest, equity earnings, and tax refunds after construction, give a total sum as follows:

First Mtge.	6 %	on 65% total	is equivalent to	3.9 % total
Second Mtge.	7½%	on 15% "	"	1.125 % "
Equity earn.	10 %	on 20% "	"	2. % "
State tax ref.	.004	on 80% "	"	.32 % "
Federal tax	2%	on int. 1st & 2nd Mtg. 5.025%	is	.1005% "
		Sum of annual charges above is equivalent to		7.4455% of total

DEVELOPMENT OFTEN A MATTER OF COVERING LOSSES

Many buildings owe their existence entirely to the need of their owners to cover the accumulated losses accruing on their undeveloped properties in the form of taxes, carrying charges, and interest. Nevertheless the true value of a property is based not on this cost but on its *potential earning capacity*. The value of land is merely the pre-discounting of its potential earnings for a reasonable time into the future.

There have been periods and districts in which land values have been inflated far beyond their income possibilities present or future. The return from space is primarily based on the current market; production costs must be adjusted to this income. Yet—

III. BUILDING COSTS MUST BE ADJUSTED TO TRUE LAND VALUES

Urban land is affected by three very important factors: Area, location, and zoning restrictions.

1. *Area:* Costs and values are so high today that it is often necessary to combine several plots to develop a profitable building.

2. *Location* value is heavily dependent on preferences of the public.

3. *Zoning:* The Equitable Building at 120 Broadway, New York City, erected before the enactment of zoning ordinances, is said by the *Wall Street Journal* to contain over one-third more space than would be possible now under the new regulations.

EXAMPLES OF TRENDS IN LAND VALUES

In a study of trends in land values over a period of time the official records of land assessments of the Times

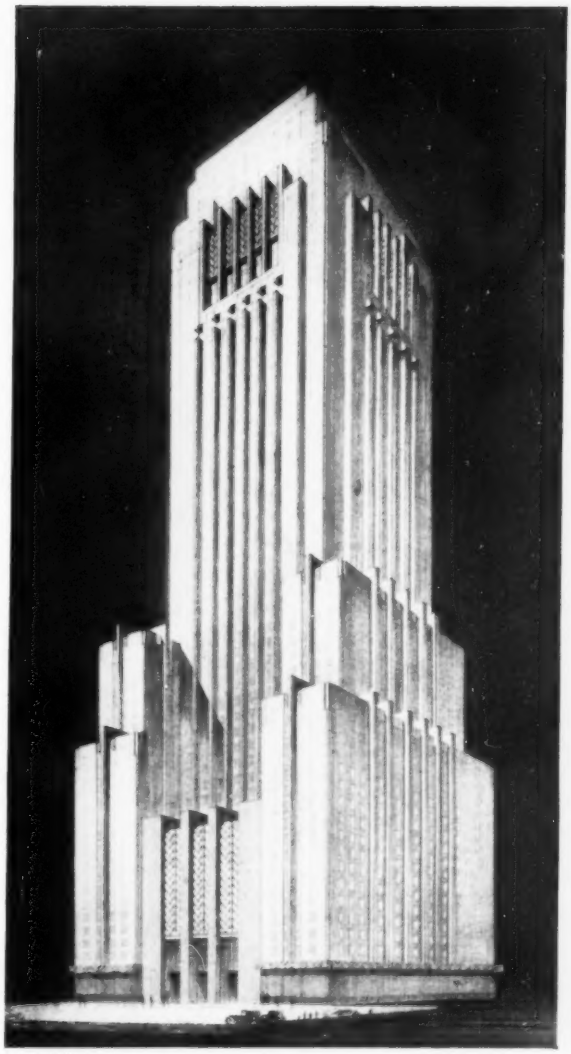
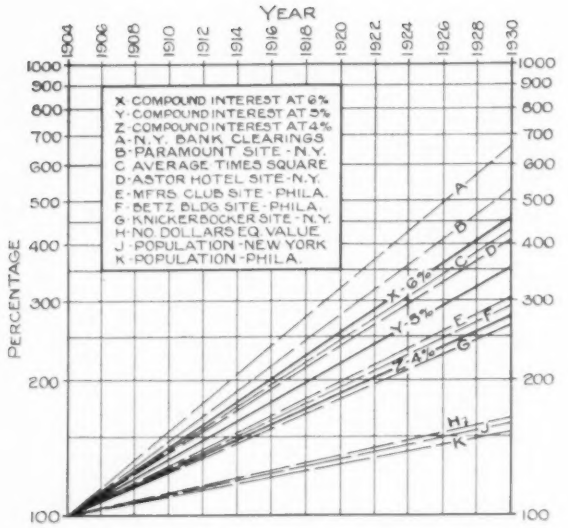


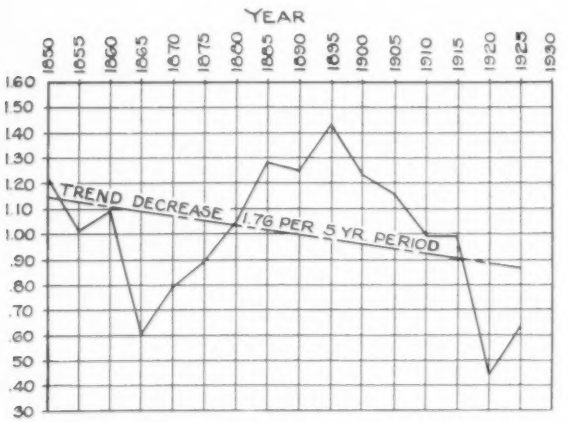
Photo. Juley

THE CLIFTON BUILDING, NEW YORK CITY
CYRUS W. THOMAS, ARCHITECT



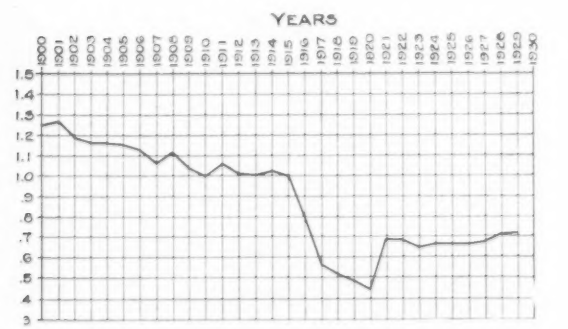
GRAPH 16. TREND OF INCREASE IN LAND VALUES

Taken at Times Square, New York City, and Broad Street, Philadelphia, and showing land values in comparison with the varying dollar value, compound interest at 4%, 5%, and 6%, with population increase in New York and Philadelphia, and with New York bank clearings



GRAPH 17. BUYING POWER OF THE DOLLAR

Based on wholesale prices in 1913 cents



GRAPH 18. BUYING POWER OF THE DOLLAR 1900 to 1929

Based on the 1913 dollar value. Some economists inform us that we are now entering a period of falling prices and of corresponding increases in the value of the dollar

Square district in New York have been taken, and represent a fair maximum in established Eastern cities. A graph has been prepared showing the increase in land values in this district since 1904. It shows that some sites have increased slightly more than others, but that the average is in the neighborhood of 400%. A comparison with the 5% compound interest line will show a close correlation.

A comparison with the line of equivalent dollar *value*, however (number of dollars necessary to equal the same actual value) indicates that of this 400% increase, a large part is illusory.

Central Philadelphia valuations have not increased quite so much. Typical examples indicate a fairly close parallel to the New York district.

There may be other districts, both in Philadelphia and New York, where land has decreased in value. Sometimes the owners themselves do not realize this since the dollar yardstick by which we measure values is unstable and has changed so greatly in purchasing power. Due allowance must be made for it over a period of time. For instance, land that has apparently doubled in value over the last 25 years has actually only remained static in actual worth, since the dollar is worth only half what it was 25 years ago. Thus a property which has shown an increase of 50% in number of dollars is actually worth less than it was.

In the study of any particular property, therefore, it becomes necessary to obtain data on the historical trend of increase or decrease in value for the site.

CASE 1. OBSOLESCENCE FOR INCREASING LAND VALUE

Consider first a development on $150 land where the building has been designed in a ratio of 1.4, or has a cost of $215 per square foot of land. Carrying charges, etc., bring the total project cost or capitalization to about $470 per square foot of plot.

Let it be assumed that this land in twenty-five years increases to 300% of its initial value, an increase which is in line with many that have occurred in our typical cities.

At the end of this time, with land at $450 per square foot, the building is in inadequate relationship to land value; and due to increased taxes and operating expense, coupled with rentals well below those obtainable with new buildings on land of this value (due to the age of the building), the margin of profit is wiped out and an actual annual deficit develops. The building is probably in a fair state of preservation but its economic life is ended.

The owner's initial equity of 22% of the total project cost of $104 per square foot of plot is reduced to $84. The building costing about $215, plus $105 carrying charges is now valueless, resulting in a loss of $320 per square foot of plot. The increase in land value has almost offset this by its enhancement of $300 per square foot of plot, so that a loss of only $20 per square foot of plot has occurred.

However the status of the owner is not very favorable, since a project cost of about $1,398 per square foot of plot is required on the new land value of $450, to bring in a proper return. The equity balance of $84 per square foot of plot is only about 6% of the new project cost in place of the 22% needed. The deficiency in equity is thus about $224, which is more severe a requirement to make up than is the loss in equity of $20. To raise this sum in 25 years, compounded at 5% interest, would require a sinking fund of $4.47 per year or approximately 1.4% on the cost of the building with carrying charges totaling $320—the value on which the replacement is based.

Graph 19 illustrates the necessity of preserving the ability to rebuild on land increasing in value.

CASE 2. STATIC LAND

In the case of static land value, the amount required to be set aside to preserve the owner's equity intact is merely equal to the building-and-carrying costs which have wasted away. This equity will suffice to rebuild as before, since the land value is unchanged and the same project cost required. The average life of a building under these conditions may well be taken at 30 years.

The original building and costs amounting to $320 per square foot of plot are therefore to be replaced in 30 years. This requires an annual sinking fund of $4.59, or 1.43% on the value wasted away.

Such a sum will both protect the owner's equity and enable him to rebuild since the requirements for both are the same in this case.

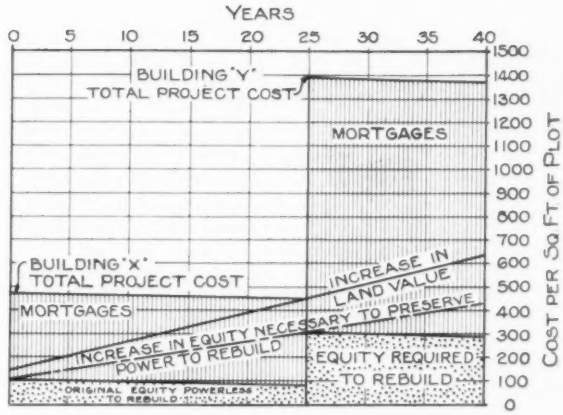
CASE 3. DECREASING LAND VALUE

On decreasing land not only must the cost of building and carrying charges be raised, but also the amount of decrease in the land value, which has also wasted away.

On the basis of the same initial costs, let us assume that the land has decreased 50% in value to $75 per square foot of plot in a 35-year period (which may reasonably be taken as the building life under these conditions). This decrease of $75 in value coupled with the building and other costs of $320, make a total of $395 which has wasted away. This sum must therefore be raised to preserve the equity value; it requires a sinking fund of about $4.17 which is approximately 1.3% on the original investment less the land value.

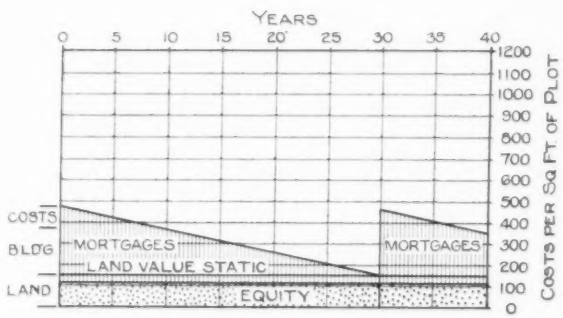
More severe cases have occurred than that indicated for rising land value. It is therefore believed that an allowance of 1½% per year based on building and carrying costs, or total investment less land value. should be allowed for obsolescence, regardless of whether land value is increasing, decreasing, or remaining static. This should be placed in a sinking fund accumulating at 5% or more.

Note that buildings in *uneconomic ratio* to their land value are subject to increased obsolescence from inadequacy, and therefore require greater sinking fund allowance than correctly proportioned buildings, due to their shorter span of useful life.


YEARS
0 5 10 15 20 25 30 35 40
BUILDING 'Y'
TOTAL PROJECT COST
MORTGAGES
BUILDING 'X'
TOTAL PROJECT COST
MORTGAGES
INCREASE IN LAND VALUE
INCREASE IN EQUITY NECESSARY TO PRESERVE POWER TO REBUILD
EQUITY REQUIRED TO REBUILD
ORIGINAL EQUITY POWERLESS TO REBUILD
1500 1400 1300 1200 1100 1000 900 800 700 600 500 400 300 200 100 0
COST PER SQ FT OF PLOT

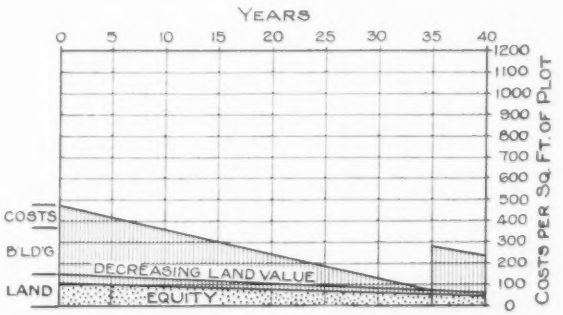
GRAPH 19. OBSOLESENCE WITH INCREASING LAND VALUES

Showing necessity of sinking fund to preserve ability of owner to rebuild



GRAPH 20. OBSOLESCENCE WITH LAND VALUE STATIC

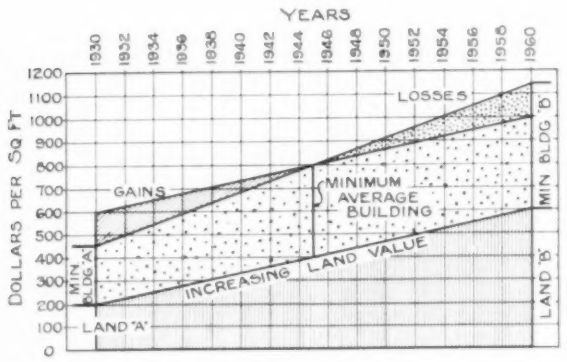
Showing wasting away of building and carrying costs and sinking fund necessary to offset it


YEARS
0 5 10 15 20 25 30 35 40
COSTS
BLDG
LAND
DECREASING LAND VALUE
EQUITY
1200 1100 1000 900 800 700 600 500 400 300 200 100 0
COSTS PER SQ. FT. OF PLOT

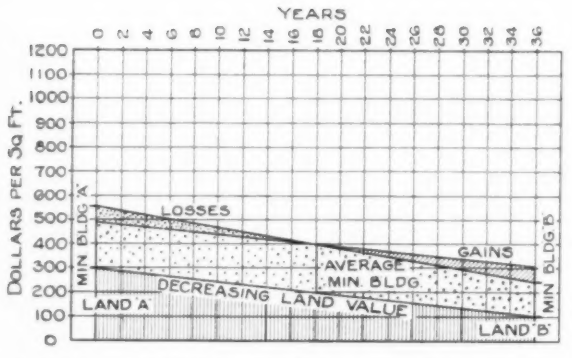
GRAPH 21. OBSOLESCENCE WITH DECREASING LAND VALUE

Sinking fund to cover building and costs and loss in land value

*The Effect of Obsolescence on the Useful Life of Office Buildings, by Earle Shultz (National Association of Building Owners and Managers, Chicago).



GRAPH 22. THE MINIMUM AVERAGE BUILDING, BASED ON INCREASING LAND VALUE
Note that the effect of compound interest is such that the gains in the first period need not be as large as they would have to be without the factor of interest, to cover the losses in the latter part of the building's life



GRAPH 23. THE MINIMUM AVERAGE BUILDING, BASED ON DECREASING LAND VALUE
Losses during the first period must not be too large because at the end of the building's life compound interest should have been earned as of its entire life

RENTAL RATES DECLINE WITH OBSOLESCENCE

A study of a number of buildings shows that the new building may obtain the maximum to be expected from the land value; thereupon, for the first period of its life, rents may increase almost in proportion to the increase in the land; during the second period they fail more and more to keep pace, and in the end may actually have to be reduced to hold the tenants.*

On decreasing land values rents decrease, with obsolescence, more rapidly than the land. Here vacancy problems as well as change of use must be included in the study.

The complete study for the life of a building, based on that of its neighbors, must be counted in estimating for this final decline.

BUILDING CYCLES OVER A PERIOD OF TIME

On any site, over a long period of time, the land value appears to follow a cycle. First it may have increased, then remained static, then decreased. This cycle has not affected all properties, but can be seen in full in certain sections of the city, and may be expected anywhere. (The shrinking dollar may mean that many properties apparently static, or slightly on the increase, are really on the decline.)

This shift of value may call for different *types* of buildings at its various stages, to satisfy the potential earnings: e. g., first a dwelling, then an apartment or store, then a larger apartment, store, or office building, and then—with the decreasing value—perhaps a loft structure.

To secure a reasonable return on a site, it is well to prevision the entire *series* of buildings on it.

THE MINIMUM BUILDING FOR THE AVERAGE FUTURE INCOME

In the face of probable changes in land value, taxes, and other costs, it becomes necessary to relate the minimum building as calculated for the present to that for the normal period of future life.

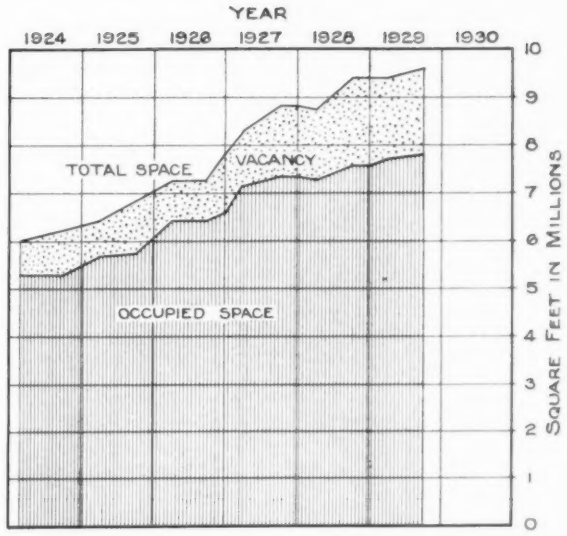
This building must be so proportioned as to afford the maximum gains by incurring the minimum losses. An *average* minimum building can thus be deduced.

Graph 22 shows such a building for rising land values, and Graph 23 one for falling land values. In each case the building has been designed to meet the *average* condition. In the first instance the building begins by being *larger* than the minimum required, thus making sufficient gains at the start to offset the losses in the end when it shall be *smaller* than the now enhanced land value requires. In the second instance this condition is reversed, and an initial loss is offset by a final gain.

More exactly stated, in the determination of the "average building" present gains *plus compound interest* must balance future losses, if land value is rising; and present losses must be balanced by future gains *discounted* in the case of falling land value.

THE PSYCHOLOGICAL TIME TO REBUILD

Demand is of course the ultimate key to the situation. The accompanying Graph 24, of the absorption rate of space in a typical city, has been compiled from accurate statistics taken over a period of years. Curves similar to this should be prepared for each district and class of building as a guide to probable future demand.



GRAPH 24. OFFICE ABSORPTION AND VACANCY IN A TYPICAL LARGE CITY
Curves similar to this should be prepared for each district and class of building. Demand is the key to the entire situation

STRUCTURAL ALUMINUM

The Aluminum Company of America has completed a new mill at Massena, New York, which can produce rolled structural members up to 14" in section. While it is not anticipated that aluminum will replace structural steel for general building purposes, there are some buildings in which it may be used to advantage on account of its lightness and also because it needs no paint.

For purposes of preliminary analysis of a problem the architect may use the following generalizations:— Aluminum structural shapes weigh about $\frac{1}{3}$ as much as steel of same section. An aluminum beam has about 2.32 times the strength of a steel beam of the same weight. Aluminum costs about six or seven times as much per ton as steel. Reducing these factors to the common denominator of cost we have: 6 (the cost per lb. compared to steel) ÷ 2.32 (strength compared to steel) = 2.6 times as great a cost as a steel beam of equal strength. This may or may not be offset by reduction in dead weight of a building or truss of long span. A New York architectural firm has recently estimated that for a certain building, with long spans and pile foundations, it would be more economical to use aluminum.

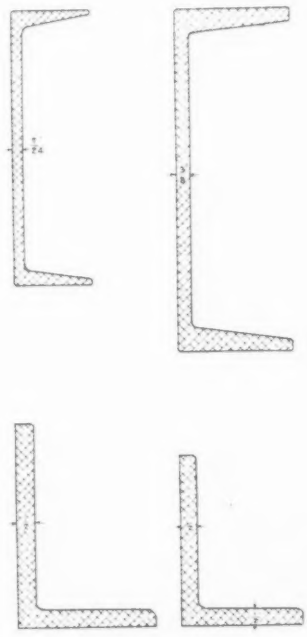
The accompanying table of "Design Stresses for Aluminum Alloys" will enable the architect to determine whether it is suitable for special uses.

DESIGN STRESSES FOR ALUMINUM ALLOYS
Values below are considered safe for ordinary structural design

	Alloy and Temper	Tension Lb./Sq. In.	Compression† Lb./Sq. In.	Bearing Lb./Sq. In.	Shear Lb./Sq. In.	Fatigue Lb./Sq. In.	Price Per Lb.
Wrought	3S0	4000	4000	4000	3000	5600	38c/43c
	3S½H	6000	6000	7000	3500	7600	38c/43c
	3SH	8000	8000	10000	4000	8400	38c/43c
	17ST	15000	15000	19000	9000	12000	40c/50c
	25SW	12000	12000	16000	7500	11600	38c/48c
	25ST	15000	15000	19000	9000	12000	38c/48c
	51SW	9000	9000	11000	6000	8400	36c/46c
	51ST	14000	14000	16000	7500	8400	36c/46c
Cast	12	5000	9000	9000	5000	6800	
	43	5000	6000	6000	4000	5200	
	195-4	7000*	11000	14000	7000	4800	

*Value given is for unaged casting. Where casting is to be aged for 3 to 6 months before use, a design stress of 9000 lb. per sq. in. is safe provided fatigue is not an important item.
†Short stiff members.

The principal building use at the present time for aluminum is in window spandrel and frame. Over 600,000 pounds of aluminum will be used for this purpose in the Empire State Building, New York City.



SOME STRUCTURAL ALUMINUM SHAPES

STRUCTURAL CLAY BY A NEW PROCESS

BY JOSEPH B. SHAW* AND MYRIL C. SHAW**

EDITORIAL NOTE: This article describes a radical innovation in the handling of clay which promises to make vitrified clay products easily available for many structural purposes.

All known clay products have been produced by methods in one respect similar: the clay was shaped first and annealed afterwards. The new process will shape the clay by pressure *while it is being vitrified*, much as steel or glass is rolled or pressed while hot.

In addition to securing new properties in the product, the new process can be used with clays or shales not available for the older processes.

The article in full, of which this is a part, will be found in the Journal of the American Ceramic Society, for March 1, 1930, by the kind permission of which we publish the section most important to architects.

In the process here described the clay is not brought to a state of fluidity such that articles may be formed from it by pouring or casting. The desirable condition for shaping the article is that of a plastic solid. All clays pass through varying degrees of fluidity during the vitrification process. The forces of surface tension and capillary attraction actually produce flow within the body of the clay during vitrification. If, at any time when clay is within this range of temperature, external pressure is applied, the clay particles will slip over one another and a dense product will be obtained. Kiln-marked brick, and deformation of fire brick in the load test, give evidence of this fact. If the temperature at which pressure is applied is low in the vitrification range, a high pressure will be required but a strong product obtained. If the temperature be somewhat higher, within the range of overfiring, a relatively small pressure will produce the desired result. If *a dense, strong product* is desired, (such as paving or structural material), the final shaping should take place before *vesicular structure* has developed to any marked extent. If a *light weight* block is desired, vesicular structure should be permitted to develop at a temperature relatively high in the vitrification range and pressure limited to that sufficient to give proper shape.

In carrying out this process the equipment and processes of the steel industry replace in large measure those of the present day ceramic plant. The product receives its ultimate shape by pressing or rolling.

If strong and dense products are desired, it is essential in the case of most clays and shales that oxidation be complete. It has been found that thin slabs, 1 inch to 2 inches thick, will oxidize rapidly and when subjected to the forming pressure the joint between such slabs is eliminated. It has also been found that a surface from a light burning clay can be pressed into a red burning central slab and give a veneered block of good strength and desired color. It is possible therefore by dry-pressing thin sections of the desired article to heat them through the dehydration and oxidation periods rapidly, in a period of a few hours as compared with days that would be required for articles of great thickness under present methods of manufacture, and at the proper temperature press the thin sections into a massive homogeneous block. It has also been found possible to reinforce these blocks effectively by inserting reinforcing steel between the sections and pressing it.

It is expected this process will be used in the production of paving slabs, massive structural materials, and heavy refractory blocks. It seems likely that vitrified clay products made under this process will be used in many cases where concrete is now used. Sea walls, piling, heavy beams, foundations, building walls, and similar articles, which are of large dimensions, and which can not be economically manufactured under the present practice, are the type of articles for the production of which this process seems ideal.

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**Graduate Student in Ceramics, Pennsylvania State College.

THE ARCHITECT'S LIBRARY

MAYA CIVILIZATION

Tulane University Expedition, 1925. Tribes and Temples. 2 vols. Tulane University of Louisiana, 1927.

Our knowledge of the developmental stages of the Maya civilization has up to the present time remained seriously incomplete, partly owing to the fact that the geographic area in which the history of the Mayas unfolded has been imperfectly explored. There are a number of "critical areas" into which it is believed the Mayas penetrated in considerable numbers, and which have not yet been adequately examined. One of these is the southern half of British Honduras; another, the south-western part of the state of Chiapas; still another—and in some respects, the most important—lies in the southern part of the state of Vera Cruz.

Did the Mayas come down off the plateau into the region of the Pánuco River, in remote times, and then emigrate south-eastwards to Chiapas, Tabasco and Guatemala, leaving the Huasteca remnant behind them? Or did the migration take place in the other direction, and do the Huastecas thus represent the advance guard of, or perhaps stragglers from, the northward moving tribes? The answer must certainly be sought in the region now lying between the Huasteca territory and the territory of the Mayas of Chiapas and Tabasco.

In "Tribes and Temples" we have the record of Tulane University's first expedition, under the leadership of Frans Blom, sent out to make a preliminary examination of three of the "critical areas"—Southern Vera Cruz, the Tabasco region, and central Chiapas. The expedition did not chance to find anything very new or very important in the Vera Cruz region.

In the Tabasco region, a number of significant finds were made. At La Venta, on the Blasillo River, some very fine sculptured figures were encountered, all evidently strongly influenced by early Mayan technical methods. At Comalcalco, a Maya city that had previously been partially studied by Charney, a most extraordinary burial chamber was discovered. It was probably the tomb of a king, and on its walls were some of the finest stucco bas reliefs ever found. The figures bear every evidence of being portraits—and good ones. Blom says in the report: "In this small chamber we stand before the best stucco work yet found in the Maya area. Even the fine stucco figures in Palenque do not reveal such mastery and freedom of line."

At Toniná, a ruined high-land city near the present town of Ocosingo, monuments carved in a highly distinctive artistic style were found. These monuments add weight to the theory, held by some, that the high-land Mayas early split off from the low-landers, and developed a more or less independent civilization.

A considerable portion of volume 2 is devoted to ethnological and linguistic studies. The former were most painstakingly done, and form a record of the tribal constitution and culture of the hitherto little-visited Maya tribes, whose history, if it could be recovered, would probably cause an entire revision of present theories in regard to development of the Maya civilization. The linguistic work is rendered less valuable than it might have been by two things: one—the most serious—is the fact that Mr. La Farge, who did the work, seems to know how to speak very little Maya. It is hard to believe that anyone who does not dominate its simpler spoken forms can do much toward analysing as difficult a language as Maya happens to be. The second handicap (at least, it is a handicap to the reader) is the phonetic alphabet used for recording the various dialects studied. This alphabet is far from clear; it has the grave defect of making use of four languages, besides Maya, for the representation of sounds—some letters are to be pronounced as in English, some as in French, some as in Spanish and one as in German. Since Mr. Blom is a Dane, that language might as well have been included, as a compliment to him. There is nothing more needed in the American linguistic field than an accurate and —what is vastly more important—a standardized phonetic alphabet. Before such a thing can be had, however, a careful and extensive study will have to be made, with recording instruments, of the phonetics of Maya and its dialects.

The report as a whole is open to some adverse criticism. The reader gets the impression that it was prepared by some one who did not exactly know how to go about it—did not know just what a scientific report ought to contain, and then did not know how the contents selected should be arranged. The book is too "popularly" written—which is a vice peculiar to American scientific books that can not be too severely condemned. Work of this sort must be presented with restraint and orderliness, and must be based on a carefully thought-out plan of presentation. The "travelogue" method employed does not add anything to its readability; and the touches of what must have been meant for "comic relief" introduced here and there mar the work considerably. This is more noticeable in the first volume. There is no reason why a report of this kind should be pedantic.

The substance of the book is excellent. In places, it is absorbingly interesting. More careful editing than was given to the first will make Tulane's second report, when it is published, a much better piece of work.

JAMES C. BARDIN

LIST OF NEW BOOKS ON ARCHITECTURE AND THE ALLIED ARTS

BOSSERT, HELMUTH THEODOR.

An encyclopaedia of colour decoration from the earliest times to the middle of the XIXth century, with explanatory text. London: V. Gollancz, Ltd., 1928. 34 p. illus., 120 col'd pl. f°. 52s 6d. 729

"The aim of this volume is to supply artists and craftsmen with a collection of coloured patterns showing what has been produced in decorative mural painting, or rather to show those noteworthy examples which have been preserved. The book does not pretend to be an illustrated history of mural painting. Attention has been called only to the purely ornamental element of wall painting."—Preface.

CECCHELLI, CARLO.

Il Vaticano, la basilica, i palazzi, i giardini, la mura. Milano: Bestetti & Tumminelli, 1928. 105, 444 p. incl. plates. f°. 500 lire. 708.5

A large and elaborate volume on the Vatican and its art treasures, including some hitherto unpublished material.

CLOUZOT, HENRI.

Papiers peints et tentures modernes (toiles et cretonnes imprimées). Paris: G. Massin, 1928. 6 p. 40 plates. f°. 150 fr. 745

A collection of modern French designs for wall papers and printed stuffs, using geometric, floral and landscape motives. Twenty of the plates are colored.

GARDNER, PERCY.

The principles of Christian art. New York: C. Scribner's Sons, 1928. 301 p. 8°. $3.50. 701

Bibliographical footnotes.

"I have tried to discover and set forth some of the general principles which underlie art, and especially the Christian art of Europe. The first part of the volume is psychological, the second part historical; and at the end I make a few tentative suggestions for a reconciliation between modern religion and art."—Preface.

HALL, HARRY REGINALD HOLLAND.

The civilization of Greece in the Bronze Age. (The Rhind lectures, 1923). With 370 illustrations and 2 maps. London: Methuen & Co., 1928. xxxii, 302 p. front., illus., maps. 4°. 30s. 709.38

"The history of this remarkable ancient culture in outline and the salient characteristics of each successive period of its development, with the aid of pictures."—Introduction.

The author is Keeper of Egyptian and Assyrian antiquities in the British Museum.

HARTE, GEOFFREY BRET.

The Villas of Pliny; a study of the pastimes of a Roman gentleman; with drawings by Max Roeder. Boston: Houghton Mifflin Company, 1928. vi, 72 p. front., illus., 6 plates. sq. 4°. $7.50. 728.8

"Printed and made in England at the Shakespeare Head Press, Stratford-upon-Avon."

A vivid verbal picture, mainly from Pliny's letters, of the Roman villa of his period. The illustrations are from paintings and drawings. The photographs of sculpture from Pliny's Tuscan villa are in private possession and have never before been published.

HERMANIN, FEDERICO.

La Farnesina; presentazione di Arduino Colasanti: prefazione del principe Ludovico Chigi-Albani. Bergamo: Istituto italiano d'arti grafiche, 1927. 102 p. 58 pl. (part col'd.). sq. f°. 300 lire. 728.3

History, architecture and mural decoration of this Roman palace of the Renaissance period.

LAYTON, EDWIN J.

Thomas Chippendale, a review of his life and origin. London: J. Murray, 1928. xv, 61 p. 4°. 10s. 6d. 749

A re-examination of documents and other evidence relative to the life of Chippendale, continuing the research made by Constance Simon in her English Furniture Designers of the 18th century, 1904, and refuting the theory of Oliver Brackett in his Thomas Chippendale, published 1924.

LUKOMSKI, GEORGII KRESKENT.

Mobilier et décoration des anciens palais impériaux russes (Musées du peuple), avec une préface de M. Louis Réau. Paris: G. van Oest, 1928. 45 p. 84 pl. f°. 250 fr. 740

An historical summary and description of Russian interior decoration and furniture of the period from 1740 to 1850 which relates it to its European prototypes, but emphasizes the originality of its adaptations. Excellent folio plates.

MAYER, AUGUST LIEBMANN.

Gotik in Spanien. Leipzig: Klinkhardt & Biermann, 1928. 299 p. illus. 4°. (Handbuecher der Kunstgeschichte. Bd. 3.) 35 marks. 723.561

Bibliographical footnotes.

A series of essays on various aspects and examples of Spanish Gothic, mainly architecture but including also sculpture, painting, metal work, illumination, etc.

MAYBON, ALBERT.

Les temples du Japon. Architecture et sculpture. Paris: E. de Boccard, 1929. 94 p. plates. f°. 60 fr. 722.1

A historical résumé of religious movements in Japan precedes the formal study of temple architecture and sculpture.

NICHOLS, ROSE STANDISH

Italian pleasure gardens; with nearly two hundred reproductions of photographs, drawings and plans. New York: Dodd, Mead & Company, 1928. xxii, 309 p. front., illus., plates. 8°. $10.00. 710

Bibliography, pp. 291–294.

A review of certain Italian gardens, either of special type or particular locality. A useful itinerary lists the gardens and gives their owners, opening days, source of permit to visit, and the like.

PORTER, ARTHUR KINGSLEY.

Spanish Romanesque sculpture. Firenze: Pantheon, 1928. 2 v. plates. f°. 1200 fr. 734

American edition; Harcourt, Brace; price $63.00.

A most specialized study, based upon archaeological research and a wide knowledge of existing examples of this period sculpture. 160 excellent plates.

Illustration shows work under construction on the hotel "The New Yorker", located on 8th Avenue, 34th to 35th Streets, New York City, which has been recently completed. Sugerman & Berger, Architects, Lange & Noska, Engineers.

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ARCHITECTS' ANNOUNCEMENTS

and Notes in Brief

CALENDAR OF EVENTS
GENERAL ANNOUNCEMENTS

April 5-12	Home Complete Exposition, Indianapolis.
May 20-Oct. 1	Exhibition of modern Architecture and Industrial Arts at Stockholm, Sweden.
May 21-23	American Institute of Architects, Sixty-Third Convention, Mayflower Hotel, Washington, D.C.
May 26-30	Fifth International Congress of Building and Public Works, London.
June 19-30	The Fourth Pan-American Congress of Architects and Architectural Exhibition at Rio de Janeiro.
Aug. 4-9	International Exposition of American Import Trade, Grand Central Palace, N. Y.
September	International Congress of Architects, Budapest.
Nov. 18-29	Art Exhibition, Royal Institute of British Architects, London (9, Conduit Street).

COMPETITIONS

April 12	Sketch given out, Booth Traveling Fellowship, University of Michigan College of Architecture. Open only to graduates of this school, under 31. For details address the College.
April 14	Third competition for the A. W. Brown Travelling Scholarship, to be held under the direction of a committee of the American Institute of Architects. A two thousand dollar scholarship towards the expenses of a year of travel and study in Europe by an architect or architectural draftsman. For application blanks write to the secretary of the committee, Wm. Dewey Foster, 25 West 45th Street, New York City.
April 19	Closing date for competitors for the Prince-Architectural Prizes of eight hundred dollars ($800) each, in the School of Architecture, Princeton University for the year 1930-31. For application blanks and regulations governing the competition and award address the Director, the School of Architecture, Princeton University, Princeton, New Jersey.

ROY C. ARNHOLD, architect, announces the removal of his offices to 910 Staley Building, Wichita Falls, Texas.

CONRAD & CUMMINGS, associated architects, are now located at 509 Binghamton Savings Bank Building, Binghamton, New York.

WILLIAM E. HAUGAARD, architect, announces the removal of his offices to 21 West 45th Street, New York City.

ANNOUNCEMENT is made that S. R. Burns has retired from the firm of Hunt & Burns, Architects. The practice will be continued by Sumner P. Hunt, under his own name, at the same address, seventh floor, Laughlin Building, Los Angeles, California.

OSCAR SCHMIDT, architect, announces the removal of his offices to 2732 Atlantic Avenue, Atlantic City, N. J.

FRANK A. WINN, JR., architect, announces the removal of his office to the Stovall Office Building, Tampa and Madison Streets, Tampa, Florida.

DESIGN FOR A PRADO

The Williams and Matilda Sparks Foundation, Inc. invites competion for the entrance design to its Prado or walk. This institution will have a tower 200 feet high, a golf course, tennis courts, an outdoor amphitheatre with a seating capacity of 15,000, canals and the above mentioned Prado 20 feet wide, 2100 feet long. The Foundation is located in Jackson, Michigan, covering 465 acres of land.

April 15th, 1930 is the closing date for the submission of all designs. The cost of the entrance itself is to be from five to ten thousand dollars. It should be designed in either stone or brick. All designs are to be on sheets 15 x 20 inches, and may be in perspective or plan and elevation, in water color, ink, pencil, or crayon.

First Prize, $250.00 cash, Second Prize, $100.00 cash, and Third Prize, $50.00 cash.

All designs and communications may be addressed to A. W. D. Hall, Chief Engineer, The Williams and Matilda Sparks Foundation, Inc., 313 Carter Building, Jackson, Michigan.

A.I.A. HONOR AWARDS

A system of honor awards, "creating year by year a visible history of the advance of architecture in the nation's cities," is being developed by the A. I. A.

A definite plan governing the determination of exceptional architectural merit has been adopted, and will be carried out by Chapters all over the country, it is announced by C. Herrick Hammond of Chicago, President of the Institute.

The plan, Mr. Hammond said, represents nation-wide extension under uniform control of honor award programs already sponsored by Chapters in New York, Chicago, Los Angeles, and other cities. The results, he pointed out, have justified the effort, as evidenced in awakened interest in good architecture and noticeable improvement in the quality of buildings recently erected.

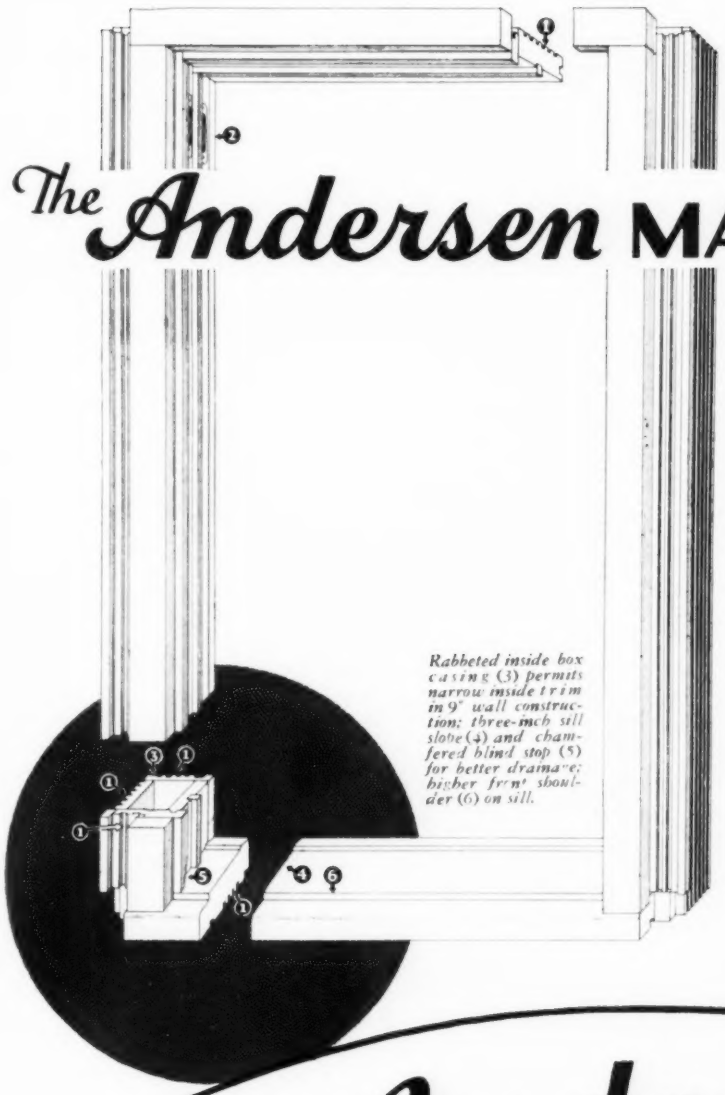
The Minnesota Chapter, Mr. Hammond also announced, has decided to issue awards for the best in Minneapolis architecture. Similar action, it is expected, will be taken by other Chapters so that eventually distinction in architecture will annually receive public recognition throughout the United States.

The honor plan was framed by a special committee of the Institute of which David J. Witmer of Los Angeles is chairman. Other members are:

Joseph D. Leland, Boston; Raymond Hood, New York; John P. B. Sinkler, Philadelphia; Nat G. Walker, Ft. Myers, Fla.; Pierre Blouke, Chicago; George W. Spearl, St. Louis; Ralph H. Cameron, San Antonio; Arthur Loveless, Seattle; Raymond W. Jeans, San Francisco.

Awards will be determined by a jury selected by the Executive Committee of the Chapter from nominations

(*Continued on page 194*)



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made by the Chapter Committee on Honor Awards. Each jury is to consist of three corporate members of the Institute not members of the awarding Chapter.

The awards apply to plan, function, and design in the following groupings: Dwellings, multiple dwellings, commercial buildings, quasi-public buildings, public schools, public buildings.

Additional awards will be made in the following groups: Group planning, city, community, and regional planning, landscape, memorials, any of the fine arts, any of the applied arts, any of the industrial arts as distinguished from the applied arts.

"A wide distribution of classification," said the Committee's report to the Board of Directors of the Institute, "does not make for a complicated program in operation. There are many types, for instance, of commercial buildings. This activity is educational and does not seek primarily to honor the creating artist.

"Therefore, if a splitting up of a group can be made whereby into each section of that group can be placed buildings of like trait so that they can be judged without conflict with buildings of a similar classification but with a different primary trait, the educational value will be furthered and the operation of the program simplified."

CHARLES MORRIS

1869–1930

The death of Charles Morris in Cleveland on January 27th, removes from the profession an architect of real ability and a man of high ethical standards. It ends for me a friendship which began in 1891 when I innocently strolled into the Atelier Laloux in Paris, with a letter of introduction to Morris from the late Thomas Hastings. Morris hurried me out in time to avoid the usual practical jokes played on visitors and we became at once intimate friends. We prepared the admission examinations together and together we bicycled through Touraine and Normandy.

Morris had the unique distinction of being the first employee of the firm of Carerre and Hastings, and to that office he returned for a time after his work at the Beaux-Arts. Later he formed a partnership with Richard Walker, doing excellent work, including a number of the Carnegie Library branches in Brooklyn. In 1902 he and I were asked to go to Cleveland to help on the design of the new Court House. After a few weeks of study on the plans the architects asked one or the other of us to stay on in Cleveland and carry the work through. This Morris did, with the result that Cleveland has one of the finest court houses in the country.

Upon his return to New York, Walker and Morris won the Twenty-Second Regiment Armory in competition, served as architects for the Municipal Ferry houses at South Ferry and the Bridge and Pavilions on Riverside Drive at Ninety-Fifth Street. Unfortunately, the partnership broke up just when success seemed to be knocking at the door. Charles Morris was then appointed Chief Designer in the office of the Supervising Architect of the Treasury where he greatly raised the standard of design. Hundreds of well designed post offices throughout the country are today a credit to his ability. With our entry into the war the appropriations for government work were discontinued and the Supervising Archirect's office practically stopped work.

After winding up his work in Washington, Morris returned to Cleveland and in 1923, formed the firm of Morris and Weinberg, to whom success was coming in a widening field when his fatal illness began. Some three years ago he was forced to suffer amputation of his leg, but far from discouraging him this handicap seemed to render him more optimistic and even more courageous in overcoming difficulties.

He was elected to Fellowship in the Institute in 1925 and also served as President of the Cleveland Chapter the following year. During all his practice he had shown special interest in architectural education, being one of the early members of the Society of Beaux-Arts Architects and serving on its Juries from time to time. He was one of the Founders of the Cleveland School of Architecture in 1922 and served as Secretary and Treasurer of the Board of Trustees until the school became officially affiliated with Western Reserve University in 1928. He remained as a member of the Board of Trustees until his death.

Charles Morris was a fine man and a true and loyal friend. Through many years he persevered without receiving the credit which was his due. In the last years of his life, though working under a severe handicap, he achieved his greatest success.

CHARLES BUTLER.

A THIRTEEN-PERIOD YEAR

The Square D Company, of Detroit, Mich., announces that all accounts, salaries and internal records of the company will now be handled on the basis of the "thirteen-period" year. The Square D Company manufactures electrical control equipment.

The new system replaces the former one of calendar months. For many years there has been considerable agitation, the world over, in favor of the thirteen-period year. A special investigation of it was conducted by the League of Nations in 1926. Today many large companies are using it as their method of operation, among them the Eastman Kodak Co., Sears, Roebuck and Co., Fuller Brush Co., C. G. Conn., Ltd., Loew's, Inc., Hicock Mfg. Co., Lukens Steel Co., and the Graton and Knight Mfg. Co. The National Association of Cost Accountants has placed itself on record as definitely in favor of it.

Under the thirteen-period year, there are exactly the same number of weeks—four—and the same number of days—28—in each of the periods, making it possible to compare operating figures among periods without any adjustment as to time units.

On this basis, all comparisons will mean a great deal more and will be considerably more serviceable than under the old system of calendar months. Under the old method, for example, the reports for February, 1929, covered only 20 working days, while the October, 1929, reports were for 23 working days, a variation of 15 per cent.

Under the thirteen-month system of operation, the customary method of referring to period dates is as follows: 3 P 27–30, meaning 27th day of the third period, 1930. However, in stating dates generally, the regular twelve-month calendar dates are used.

Rae and Son's Shoe Store, Vancouver, British Columbia — A Desco Installation.

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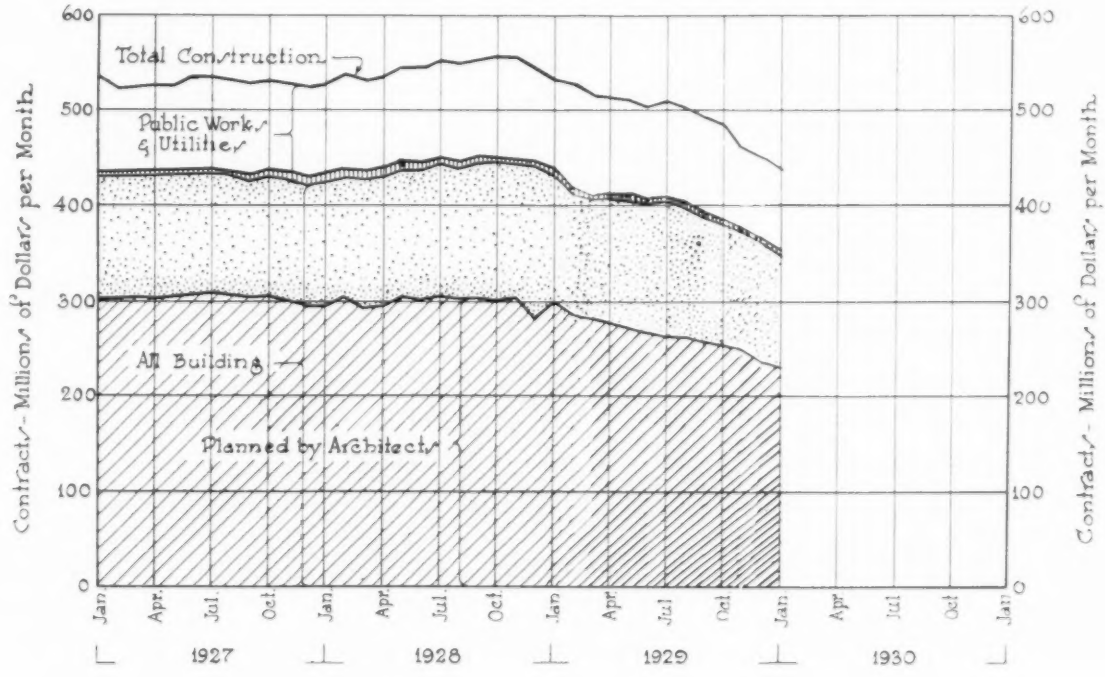
CONSTRUCTION STATISTICS

From the records of F. W. DODGE CORPORATION, Statistical Division. The figures cover the 37 states east of the Rocky Mountains and represent about 91 per cent. of the country's construction volume.

January, 1930

Classification	TOTAL CONTRACTS Number of Projects	TOTAL CONTRACTS Valuation	WORK PLANNED BY ARCHITECTS Number of Projects	WORK PLANNED BY ARCHITECTS Valuation	Per Cent of Total
Commercial Buildings	1,670	$ 54,052,300	634	$ 43,031,000	80
Industrial Buildings	379	38,266,200	149	27,062,600	71
Educational Buildings	182	19,009,200	150	18,041,100	95
Hospitals & Institutions	63	6,783,400	48	5,899,500	87
Public Buildings	69	8,567,100	40	8,173,300	95
Religious & Memorial Buildings	103	5,504,400	64	4,995,900	91
Social & Recreational Projects	153	13,095,500	93	11,805,500	90
Residential Buildings	4,168	66,631,900	1,059	37,555,100	56
Total Building	6,787	211,910,000	2,237	156,564,000	74
Public Works & Utilities	800	112,065,200	29	5,018,900	4
Total Construction	7,587	$323,975,200	2,266	$161,582,900	50
Total Construction, January, 1929	10,190	$409,967,900	3,133	$221,606,600	54



General Trend of Building and Engineering Construction